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Land Use and Urban Development Project

STUDY OF RETAIL SALES AND SERVICES

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The BART Impact Program is a comprehensive, policy-oriented study and evaluation of the impacts of the San Francisco Bay Area's new rapid transit system (BART).

The program is being conducted by the Metropolitan Transportation Commission, a nine-county regional agency established by state law in 1970.

The program is financed by the U. S. Department of Transportation, the U. S. Department of Housing and Urban Development, and the California Department of Transportation. Management of the Federally funded portion of the program is vested in the U. S. Department of Transportation.

The BART Impact Program covers the entire range of potential rapid transit impacts, including impacts on traffic flow, travel behavior, land use and urban development, the environment, the regional economy, social institutions and life styles, and public policy. The incidence of these impacts on population groups, local areas, and economic sectors will be measured and analyzed. Finally, the findings will be interpreted with regard to their implications for the planning of transportation and urban development in the Bay Area and other metropolitan areas.

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BART IMPACT PROGRAM

LAND USE AND URBAN DEVELOPMENT PROJECT

STUDY OF RETAIL SALES AND SERVICES

April 1978

(Revised July 1978)

WORKING PAPER

PREPARED FOR

U.S. DEPARTMENT OF TRANSPORTATION

AND

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

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NOTICE

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A JOINT VENTURE

UNDER CONTRACT WITH THE METROPOLITAN TRANSPORTATION COMMISSION
FOR THE U.S. DEPARTMENT OF TRANSPORTATION
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16. Abstract

This study focuses on how BART is influencing the distribution and volume of retail sales in the BART service area. Shoppers in six retail areas were surveyed to ascertain how their shopping patterns had changed since BART service began. Retailers throughout the BART service area were interviewed to determine whether BART influenced their location decisions or retail sales. Sales tax data in seventeen retail areas were analyzed to search for sales trends associated with proximity to BART.

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Metropolitan Transportation Commission

SAN FRANCISCO BAY REGION

CENTRAL AREA

BART: The Bay Area Rapid Transit System

Length: The 71-mile system includes 20 miles of subway, 24 miles on elevated structures and 27 miles at ground level. The subway sections are in San Francisco, Berkeley, downtown Oakland, the Berkeley Hills Tunnel and the Transbay Tube.

Stations: The 34 stations include 13 elevated, 14 subway and 7 at ground level. They are spaced at an average distance of 2.1 miles: stations in the downtowns are less than one-half mile apart, while those in suburban areas are two to four miles apart. Parking lots at 23 stations have a total of 20,200 spaces. There is a fee (25 cents) at only one of the parking lots. BART and local agencies provide bus service to all stations.

Trains: Trains are from 3 to 10 cars long. Each car is 70 feet long and has 72 seats. Top speed in normal operations is 70 mph with an average speed of 36 mph including station stops. All trains stop at all stations on the route.

Automation: Trains are automatically controlled by the central computer at BART headquarters. A train operator on board each train can override automatic controls in an emergency.

Magnetically encoded tickets with values up to $20 are issued by vending machines. Automated fare gates at each station compute the appropriate fare and deduct it from the ticket value. At least one agent is present at each station to assist patrons.

Fares: Fares range from 25 cents to $1.45, depending upon trip length. Discount fares are available to the physically handicapped, children 12 and under, and persons 65 and over.

Service: BART serves the counties of Alameda, Contra Costa and San Francisco, which have a combined population of 2.4 million. The system was opened in five stages, from September 1972 to September 1974. The last section to open was the Transbay Tube linking Oakland and the East Bay with San Francisco and the West Bay.

Routes are identified by the terminal stations: Daly City in the West Bay, Richmond, Concord and Fremont in the East Bay. Trains operate from 6:00 a.m. to midnight on weekdays, every 12 minutes during the daytime on three routes: Concord-Daly City, Fremont-Daly City, Richmond-Fremont. This results in 6-minute train frequencies in San Francisco, downtown Oakland and the Fremont line where routes converge. In the evening, trains are dispatched every 20 minutes on only the Richmond-Fremont and Concord-Daly City routes. Service is provided on Saturdays from 9 a.m. to midnight at 15-minutes intervals. Future service will include a Richmond-Daly City route and Sunday service. Trains will operate every six minutes on all routes during the peak periods of travel.

Patronage: Approximately 142,000 one-way trips are made each day. Approximately 200,000 daily one-way trips are anticipated under full service conditions.

Cost: BART construction and equipment cost $1.6 billion, financed primarily from local funds: $942 million from bonds being repaid by the property and sales taxes in three counties, $176 million from toll revenues of transbay bridges, $315 million from federal grants and $186 million from interest earnings and other sources.

March 1978

PREFACE

The BART Impact Program (BIP) is a comprehensive policy-oriented effort to identify, describe, measure, and present findings as accurately as possible about the multi-faceted impacts of a major public transportation investment—the BART system. The major objective of the Land Use and Urban Development Project is to determine how and to what extent BART has influenced the spatial arrangements of people and activities within the San Francisco Bay Area. To accomplish this task, the project will focus on the way BART has influenced (1) location decision processes; (2) actual movement behavior that results from those decisions and other market forces; and (3) the form, character, and functioning of aggregate spatial groupings that represent the net outcome of those decisions and movement patterns. Changes attributable to BART will be measured against pre-BART and no-BART alternatives. In all of these studies BART's effects on individual socio-economic groups, particularly minorities and the disadvantaged, will receive careful attention.

The Land Use and Urban Development Project is one of six major projects comprising the BART Impact Program. The others are:

- Economics and Finance Project (E&F)
- Environment Project (Env)
- Institutions and Lifestyle Project (ILS)
- Public Policy Project (PP)
- Transportation System and Travel Behavior Project (TSTB)

Each of these projects is designed to investigate specific aspects of BART's impacts, to explain why the impacts occur, and to identify who is affected by the impacts and the distributional effects. The projects then will demonstrate how the information derived can be used by decision-makers to enhance the benefits and to reduce the dis-benefits of BART and to increase understanding of the potential impacts of rail rapid transit investments in the Bay Area and other American metropolitan areas.

This working paper presents the analysis and findings of the study of BART's impact on retail sales and services—one aspect of BART's impacts on land use and urban development. The paper is presented for review by BART Impact Program staff, federal sponsors, and other interested planners and researchers.

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SUMMARY AND FINDINGS

OBJECTIVES

This study's primary concern is how BART is influencing the location pattern and volume of retail sales and services in the three-county BART service area. Three measures of BART's influence have been examined: how BART has affected the shopping trips and shopping habits of customers, how BART is viewed by retailers, and how BART may be influencing the pattern of retail sales.

APPROACH

BART's effects on shopping trips and shopping habits were examined through a shopper survey administered to 499 shoppers in six shopping areas served by BART. The survey focused on the shopper's current shopping trip, his or her overall shopping pattern, and demographic characteristics. Because the survey sample was screened for length of residence and for people who were on errands or shopping trips, and because about half the respondents were BART riders, the sample cannot be considered representative of the entire BART service area population. Nevertheless, the findings of BART's effects presented here may be indicative of similar effects among the regional population. We conducted thirty-five interviews of retailers and others knowledgeable about retail sales activity and examined interviews conducted for other studies in the BART Impact Program to determine how retailers perceive BART to be affecting their businesses, and to learn how important retailers consider proximity to BART when choosing a new location. Finally, we analyzed sales tax data for seventeen different shopping areas to determine whether proximity to BART could be associated with changes in sales. The sales tax data were then reaggregated according to each store's distance from the nearest BART station. The reaggregated data were analyzed to determine whether sales patterns could be associated with distance to the BART station.

FINDINGS

HYPOTHESIS 1: People's choice of locations for shopping and other services has favored establishments in shopping areas served by BART.

Survey results suggest that BART is having some intra-regional effect on shopping patterns. Respondents who have recently begun shopping in downtown San Francisco, downtown Oakland or Walnut Creek showed a significantly higher propensity to use BART on their shopping trips to these areas than did people who have shopped in the areas since before 1974. In both downtown San Francisco and Walnut Creek, over 40 percent of the "new" shoppers cited BART as the reason for patronizing the area.

Survey respondents who were transportation disadvantaged relied on BART for shopping trips significantly more than others. The transportation disadvantaged,

people without access to private vehicles, include low income individuals and widowed, divorced or never-married people. Except for low income individuals, these groups showed a significantly higher use of BART than did the sample as a whole. The sample showed no difference in BART use according to race, income or education.

Survey respondents who were long-distance commuters also exhibited a significantly higher propensity to use BART on shopping trips than did the sample as a whole. On the other hand, shoppers who work in the transit-oriented central cities showed no higher propensity to use BART on shopping trips.

BART use by the sample population differed according to type of shopping trip. People on personal errands, such as visiting a dentist or a bank, showed a significantly higher use of BART than did people on other types of trips. In contrast, people shopping for groceries or for household appliances showed a significantly lower propensity to use BART than did people on other types of shopping trips.

HYPOTHESIS 2: Location decisions for retail establishments and other population-oriented services favored sites that gained improved accessibility to clients' dwellings, workplaces, or other activity centers as a result of BART.

The retailers interviewed generally did not consider BART to be an important factor in their choices of new locations for retail establishments. Informants whose stores were located in the central cities considered access to busses more important than access to BART, while those in the suburbs considered automobile access far more important than access to BART. BART's only important location influence was indirect: stores and firms locating in Oakland's City Center Project probably would have located elsewhere had BART not been built because BART provided the local funding necessary for that redevelopment project.

Of the four informants interviewed about stores which left a BART station area, only one said that BART could have been an influence in the store's decline. In that case, BART's construction disrupted traffic flows past the store, contributing to the decrease in business.

Many retail and service employees were found to use BART as a means of commuting. The closer the store was to a BART station, the higher the proportion of employees using BART and the more likely that the proportion is increasing over time.

HYPOTHESIS 3: The distribution of retail sales shifted toward commercial areas within walking distance of BART stations and sites along the pedestrian routes leading to the BART stations.

Six informants of the thirty-three interviewed reported that BART has had a helpful effect on their sales. The stores reporting this effect are concentrated in the central city area of San Francisco and Oakland, and two of the six have entrances directly into the BART station. A much higher proportion of stores mention BART's proximity in their advertising.

However, analysis of retail sales data sampled throughout the downtown shopping areas of San Francisco, Oakland, and Berkeley indicates that proximity to BART stations has not had a positive effect on sales from 1970 through 1976. Analyses of retail sales from seventeen shopping areas throughout the BART service area were inconclusive as to the effects of proximity to BART.

1. INTRODUCTION

BART was expected to increase the mobility of the population in its service area, and it was thought that this increase in mobility might lead to a substantial shift in the pattern of retail sales and services. The broad aim of this study is to investigate whether such a redistribution is actually occurring. Narrower issues addressed in this study also include whether retail activity in the suburbs or the central cities is more favored by any BART-induced redistribution of sales and services, whether BART has generated any new retail centers, whether some socio-economic groups use BART differently for shopping than do other groups, and whether some types of retail establishments are affected differently by BART than are other types.

This study approaches the topic of BART effects on retail sales and services from three different perspectives. First, a survey of shoppers reveals how BART is influencing the pattern of shopping trips. Second, interviews with retailers indicate how they perceive BART to be affecting their businesses and their location decisions. Third, regression analysis of sales tax data suggests to what extent proximity to BART is responsible for changes in retail sales data over the past six years.

2. RESEARCH QUESTIONS AND STUDY APPROACH

OBJECTIVES

This study's principal objective is to determine what influence BART has had on the pattern of retail sales and services in the three-county area it serves. BART's effects on sales and services were addressed in three ways: by investigating how consumers use BART on shopping trips and how BART may have affected their shopping habits; by interviewing retailers to determine how BART has influenced their location decisions and how they perceive BART to have affected their sales; and by analyzing sales tax data for seventeen shopping locations in the BART service area to evaluate whether any part of the changes in sales over the past six years can be attributed to BART.

The medium through which BART might affect sales patterns or retailers' location decisions would be through BART-induced shifts in shopping habits. If BART were found to increase the patronage of some areas, corresponding changes in sales revenues would occur. Such increases in sales revenues would tend to enhance the attractiveness of the sites to prospective merchants, and that change ought to be reflected in the merchants' location decisions. The survey used in this study investigated the primary question of whether shoppers have changed their shopping patterns due to BART's existence. The issue is stated in the following hypothesis:

HYPOTHESIS 1: People's choice of locations for shopping and other services has favored establishments in shopping areas served by BART.

The survey investigated several facets of BART's effects on shopper behavior: whether BART has influenced shopping habits; if so, whether the outlying areas or the central cities have benefitted more, which socio-economic groups use BART more to shop; whether people use BART for shopping primarily on shopping-oriented trips or on work or other trips; and which type of shopping trip is most likely to be influenced by BART. (Demographic characteristics of the respondents are presented in **Appendix H.**)

In order to facilitate statistical tests of these concepts with the survey data, the above hypothesis has been restated into a series of more precise hypotheses:

1-A. Shoppers who ride BART have increased their patronage of shopping areas with BART access, in relation to shoppers who do not ride BART.

1-B. Shoppers who ride BART shop more frequently at shopping areas with BART access than do shoppers who do not ride BART.

1-C. For shoppers who ride it, BART is an important inducement to increase their shopping in areas with BART access.

1-D. Shoppers who ride BART have shifted their shopping patterns in favor of the older, BART-served downtown areas of San Francisco and Oakland.

1-E. Shoppers who ride BART have shifted their shopping patterns in favor of the outlying shopping areas such as El Cerrito Plaza and Walnut Creek.

1-F. BART provides shopping transportation to people differently, according to their demographic characteristics:

a. Age
b. Access to private vehicles
c. Ethnic background
d. Marital status and recent change in marital status
e. Income
f. Education

1-G. People stopping to shop on the way between home and workplace are more likely to use BART for shopping than are people on a shopping trip to and from their home.

1-H. People who work in transit-oriented areas (downtown San Francisco and downtown Oakland) are more likely to use BART for shopping than are people who do not work in transit-oriented areas.

1-I. Shoppers who are relatively long-distance commuters are more likely to use BART for shopping than are shoppers who are not long-distance commuters.

1-J. People shopping for personal items or who are on a personal errand are more likely to ride BART for that purpose than are those who are shopping for bulky items.

The key informant interviews with retailers focused on how BART had affected their location decisions. This concern is reflected in the following hypothesis:

HYPOTHESIS 2: **Location decisions for retail establishments and other population-oriented services favored sites that gained improved accessibility to clients' dwellings, workplaces, or other activity centers as a result of BART.**

Finally, sales tax data were analyzed to determine whether BART has had any measurable effect on retail sales in areas with BART access. This question is stated in the following hypothesis:

HYPOTHESIS 3: **The distribution of retail sales shifted toward commercial areas within walking distance of BART stations and sites along the pedestrian routes leading to the BART stations.**

APPROACH

This section is divided into three parts, corresponding with the study's three major components: the survey of shoppers, key informant interviews, and analysis of sales tax data.

Survey of Shoppers

In order to learn how consumers use BART on shopping trips and errands, and how their use of BART has affected their shopping habits, we designed and implemented a shopper survey. The survey investigated both the shopper's current shopping trip and his or her overall shopping pattern. Questions on the current shopping trip were directed to the origin, destination, whether BART was used, and what specific item or errand the trip was for. Questions were also directed to how often the respondent used BART, whether the shopping area was used more frequently than in 1974,[1] and the reasons for changed usage (if any). Respondents were asked to name the areas where they currently shopped most frequently, those they most often used in 1974, and which areas they traveled to via BART.[2]

Respondents were screened at the beginning of the interview so that the sample included only those who were in the area on a shopping trip or a personal errand, and who had lived within the BART service area at least since 1974. The latter condition was used to ensure a meaningful response to the question of whether the respondent used particular shopping areas prior to 1974.

Finally, at the end of the interview a set of questions was asked in order to determine whether BART's influence on shopping habits varied by socio-economic characteristics. The survey instrument itself is included in this report as **Appendix A.**

The survey was administered at six locations, listed below, and shown in **Figure 1:**

1. Downtown San Francisco
2. Downtown Oakland
3. Downtown Berkeley
4. El Cerrito Plaza Shopping Center
5. San Francisco's Mission District
6. Walnut Creek

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1. 1974 was chosen as a point of comparison because trans-Bay service did not begin until November, 1974.

2. The technique of soliciting retrospective responses was necessary because comparable pre-BART patronage data did not exist. A weakness of this approach, pointed out by Martin Gellen (University of California, Berkeley, Department of City and Regional Planning), is that it fails to measure shoppers who have ceased shopping in an area they patronized before 1974. Thus, the survey findings cannot indicate absolute or differential losses of patronage during that period.

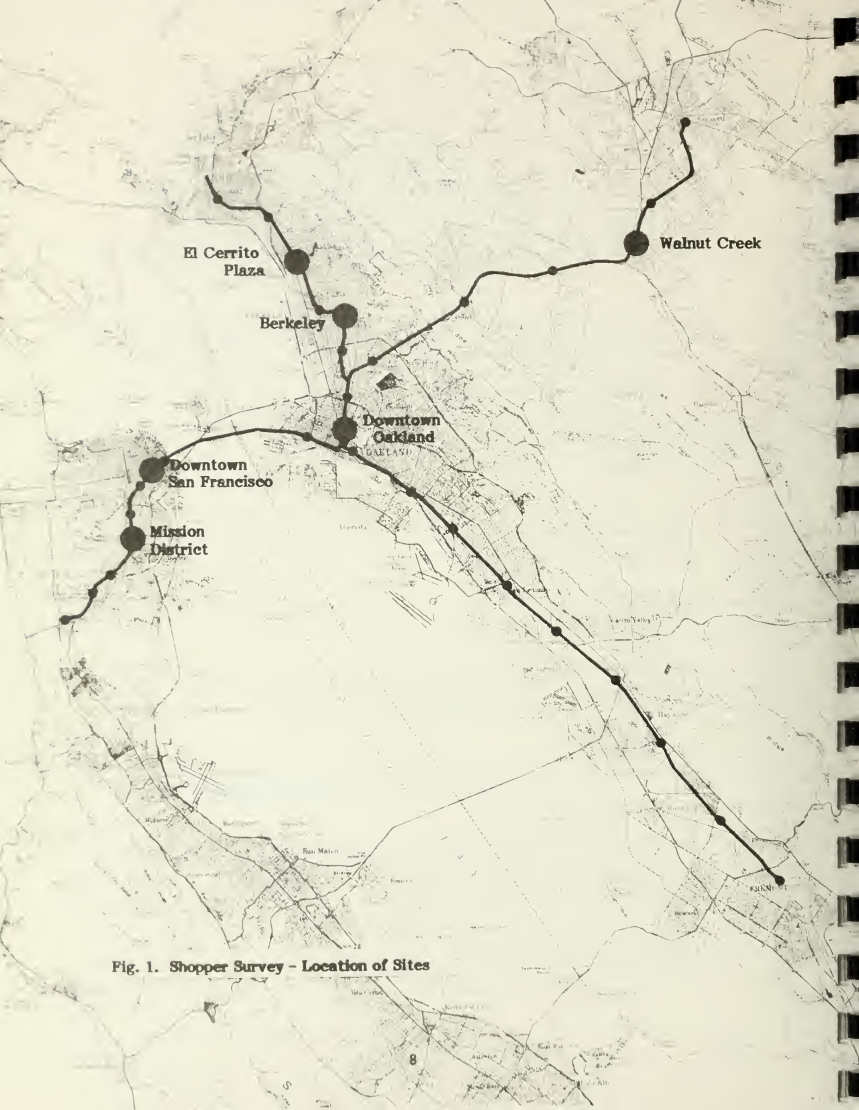

Fig. 1. Shopper Survey - Location of Sites

The locations were chosen on the basis of the following criteria:

- all areas have BART access
- all are regional as opposed to local shopping areas
- four of the six are case study areas included in the Program-Wide Case Study Work Element
- the nearby BART stations all show a relatively high percentage of shopping trips among exiting BART riders
- the areas represent a balance between urban and suburban areas and include users from various ethnic groups

The survey was administered in November, 1977, in all six locations. Interviews were conducted on weekdays between 10 a.m. and 6 p.m. At least eighty shoppers were interviewed at each location, and a total of 499 interviews were completed. In order to compare the characteristics of shoppers who ride BART with those of shoppers who do not ride BART, it was intended that the sample be equally divided between BART riders and non-BART riders. Therefore, the interviewing was begun in the vicinity of the retail establishments located near the BART stations until the full sample of non-BART riders was obtained. Then, the interviewing shifted to the BART station to complete the sample of shoppers who rode BART. All respondents were selected using an "Nth" person sampling technique, and the overall sample can be considered representative of all shoppers who were in the six locations during the interviewing periods and who met the screening criteria.[3]

Of the 1,588 persons approached for an interview, 499 (31 percent) completed the survey, 576 (36 percent) failed to pass one or more of the screening criteria, 487 (31 percent) refused to be interviewed, and 26 (2 percent) could not be interviewed because of a language barrier.

At the end of the interviewing, all questionnaire responses were coded and punched onto IBM cards for computer processing. The Statistical Package for the Social Sciences (SPSS) was used for processing and testing the questionnaire data, the results of which are reported in the "Findings" Chapter of this study. The data deck will be available in the Metropolitan Transportation Commission Data Library at the end of this project.

Key Informant Interviewing

A second perspective on BART's retail sales effects was gained from interviewing retailers themselves. This study relied on three sources of interview data. First, during the course of this study we conducted thirty-five interviews. Second, the Economics and Finance Project of the BART Impact Program made

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3. For further explanation of the survey methodology, see Tyler Research Associates, Survey Methodology for the Study of Shopping Locational Decisions (Berkeley: BART Impact Program Land Use and Urban Development Project Working Note, January 1978).

available to us notes from the interviewing done for their Impacts of Transportation Service on Employment and Commerce. Third, interviews were also available from the Study of the Office Construction Industry, another work element of this Land Use and Urban Development Project of the BART Impact Program.

After screening the key informant interviews available from the other studies, we selected additional informants and designed the questions to fill data gaps and to focus more specifically on the particular issues in this study. Field surveys were conducted from BART to identify those stores located close to a BART station and those with an entrance in a BART station. Realtors and city officials were contacted to inform us of stores which had recently moved or which were planning to move either away from or close to a BART station. Firms offering consumer services were included as well as retail stores. Informants were selected on the basis of the following criteria:

1. The informant should either be a participant in a recent or a proposed location decision, or be familiar with a long-established store having good BART access.

2. The informants were to be from a variety of firm types, including those offering services, and several types of retail stores.

3. The informants were to be from a variety of cities within the three-county BART service area.

4. Some informants should provide a minority perspective on the study issues.

Informants interviewed for this study are listed in **Appendix C.**

The key informant interviews pursued three lines of questioning. First, what were the primary elements in the location decision and how did BART affect that decision? Second, how has BART affected sales and what has been the store's response to BART (in terms of advertising, hours, promotions, etc.)? Third, how do employees use BART and how is BART affecting the store's recruitment of employees? The specific questions asked are listed in **Appendix D.**

The interviews done for Impacts of Transportation Service on Employment and Commerce focused on the issue of whether BART has provided improvements in operating efficiency for firms with BART access. Many retailers were questioned about BART's role in the firm's location decisions, and their interviews were directly applicable to this study. The Employment and Commerce interviews drawn upon for this study are listed in **Appendix E.**

The broad issue under investigation in the Study of the Office Construction Industry was BART's effect on office location decisions. In a few instances the offices involved were associated with retailers or service providers, or the informants discussed BART's retail effects as well as its office effects. In those cases the interviews provided information useful to this study. The interviews used from the Study of the Office Construction Industry are listed in **Appendix F.**

The locations were chosen on the basis of the following criteria:

- all areas have BART access
- all are regional as opposed to local shopping areas
- four of the six are case study areas included in the Program-Wide Case Study Work Element
- the nearby BART stations all show a relatively high percentage of shopping trips among exiting BART riders
- the areas represent a balance between urban and suburban areas and include users from various ethnic groups

The survey was administered in November, 1977, in all six locations. Interviews were conducted on weekdays between 10 a.m. and 6 p.m. At least eighty shoppers were interviewed at each location, and a total of 499 interviews were completed. In order to compare the characteristics of shoppers who ride BART with those of shoppers who do not ride BART, it was intended that the sample be equally divided between BART riders and non-BART riders. Therefore, the interviewing was begun in the vicinity of the retail establishments located near the BART stations until the full sample of non-BART riders was obtained. Then, the interviewing shifted to the BART station to complete the sample of shoppers who rode BART. All respondents were selected using an "Nth" person sampling technique, and the overall sample can be considered representative of all shoppers who were in the six locations during the interviewing periods and who met the screening criteria.[3]

Of the 1,588 persons approached for an interview, 499 (31 percent) completed the survey, 576 (36 percent) failed to pass one or more of the screening criteria, 487 (31 percent) refused to be interviewed, and 26 (2 percent) could not be interviewed because of a language barrier.

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3. For further explanation of the survey methodology, see Tyler Research Associates, Survey Methodology for the Study of Shopping Locational Decisions (Berkeley: BART Impact Program Land Use and Urban Development Project Working Note, January 1978).

available to us notes from the interviewing done for their Impacts of Transportation Service on Employment and Commerce. Third, interviews were also available from the Study of the Office Construction Industry, another work element of this Land Use and Urban Development Project of the BART Impact Program.

After screening the key informant interviews available from the other studies, we selected additional informants and designed the questions to fill data gaps and to focus more specifically on the particular issues in this study. Field surveys were conducted from BART to identify those stores located close to a BART station and those with an entrance in a BART station. Realtors and city officials were contacted to inform us of stores which had recently moved or which were planning to move either away from or close to a BART station. Firms offering consumer services were included as well as retail stores. Informants were selected on the basis of the following criteria:

1. The informant should either be a participant in a recent or a proposed location decision, or be familiar with a long-established store having good BART access.

2. The informants were to be from a variety of firm types, including those offering services, and several types of retail stores.

3. The informants were to be from a variety of cities within the three-county BART service area.

4. Some informants should provide a minority perspective on the study issues.

Informants interviewed for this study are listed in **Appendix C.**

The key informant interviews pursued three lines of questioning. First, what were the primary elements in the location decision and how did BART affect that decision? Second, how has BART affected sales and what has been the store's response to BART (in terms of advertising, hours, promotions, etc.)? Third, how do employees use BART and how is BART affecting the store's recruitment of employees? The specific questions asked are listed in **Appendix D.**

The interviews done for Impacts of Transportation Service on Employment and Commerce focused on the issue of whether BART has provided improvements in operating efficiency for firms with BART access. Many retailers were questioned about BART's role in the firm's location decisions, and their interviews were directly applicable to this study. The Employment and Commerce interviews drawn upon for this study are listed in **Appendix E.**

The broad issue under investigation in the Study of the Office Construction Industry was BART's effect on office location decisions. In a few instances the offices involved were associated with retailers or service providers, or the informants discussed BART's retail effects as well as its office effects. In those cases the interviews provided information useful to this study. The interviews used from the Study of the Office Construction Industry are listed in **Appendix F.**

Statistical Analysis of BART's Effects on Retail Sales

Records of taxable retail sales have been maintained for samples of stores in sixteen East Bay locations and in downtown San Francisco from 1970 through 1976. These data (described fully by Louis P. Bucklin in BART-II, Part IV, Impact on Retail Sales, IURD, U.C. Berkeley, 1973) include total annual taxable retail sales for groups of, on the average, six stores. Sets of stores, rather than individual establishments, had to be used to maintain confidentiality. The centers that were sampled are shown in **Figure 2**. In addition to being identified by location, the sets of stores were also categorized as shopping, convenience, or large stores.

The longitudinal survey encountered numerous difficulties, such as changes in ownership and use of the sampled stores, conversion to non-retail use, and close-outs. Sample replacements complicated and obscured the initial categorization scheme, so that now the samples can best be classified as (1) a sample of all stores in each center, and (2) a large-store sample, which should include the major proportion of retail sales in each center. The first category contains about 510 stores, the second about 70. Because of irregular changes in sample size, sales per store[4] was selected as the unit of analysis.

Preliminary graphs revealed no distinct differences between the sales patterns of stores located near BART and those far away, indicating that if indeed proximity to BART affected retail sales, the effects were complicated by other factors. In order to isolate potential BART effects, regression analyses were performed on the two groups of sales data. The dependent variable in the regressions was real[5] growth in retail sales from 1970 to 1976. Preliminary graphs indicated that a linear approximation was most adequate for the data, and growth was therefore measured by the β coefficient of the best fitting straight line.

Independent variables in the regression equation were:

Distance to BART. We hypothesized that distance to BART would have a negative effect on sales, or conversely, proximity would be positively associated with sales. Several types of distance measures were studied for each set of stores: mean distance to the nearest station in feet, the mean of the square roots of the distance to the nearest station in feet, the proportion of stores within 600 feet of the station, and the proportion within 1,500 feet of the station. In the analysis of reaggregated sales data for the San Francisco, Oakland, and Berkeley downtowns, the proportion of stores within 150 feet and the proportion within 300 feet of a BART station were used in addition to the mean distance.

Market area population growth was expected to have a positive effect on sales. Populations for 1970 and 1975 were measured for both primary and secondary market areas, and the percentage change between the two years was selected

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4. I.e., the total sales of a set of stores for a given year divided by the number of stores in that set during that particular year.

5. Throughout this study, the word "real" is used in the economic sense to denote adjustment for change in price level, according to the consumer price index.

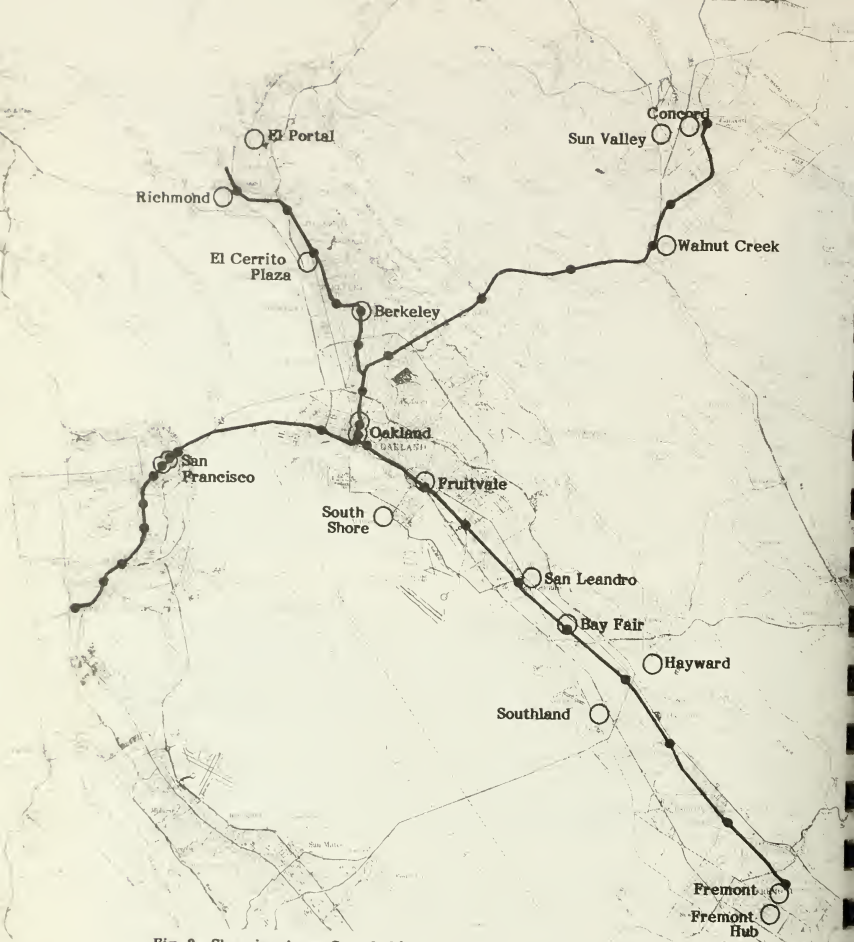

Fig. 2. Shopping Areas Sampled in Retail Sales Analysis

to indicate population growth. Based upon key informant interviews, the primary market areas were defined as the area within a five-mile radius of each center. The secondary market areas varied in size depending upon the size of the shopping center. Downtown San Francisco's secondary market area included Alameda, Contra Costa, San Mateo, and Marin Counties and the remaining parts of San Francisco County. Alameda County (minus the primary market populations) constituted the secondary market for Bay Fair, Southland and Oakland; the non-primary market portion of Contra Costa County the secondary market for Walnut Creek, and the remainder of Contra Costa County and Solano County for Sun Valley.

Several of the smaller centers were judged to support no secondary market. A combined primary-secondary market area population growth factor was also studied, but found to be less descriptive than the separate distinctions. Population data were obtained from the 1970 U.S. Census, the California Department of Finance,[6] and the Association of Bay Area Governments (ABAG).[7]

Changing income of the surrounding area was thought to be a potentially significant determinant of sales, with upward income shifts being associated with higher growth in sales. Income changes were indicated by the percentage change in mean family income from 1970 to 1975 in each five-mile primary market area. These figures were derived from a sample of six geographically dispersed census tracts in each primary market area.[8] The 1970 mean family incomes were provided by U.S. Census data, the 1975 incomes by ABAG data base information.[9] Because the ABAG figures included single-person households, they were revised upward by a factor of 1.16, corresponding to the ratio of the median family income to median household income for the United States in 1975.[10] In four sampled areas where the average family size was found to be 85 percent or below California's average (according to 1970 census data),[11] mean 1975 incomes were

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6. California Department of Finance, Population Research Unit, "Table 2. Total Population of California Counties — July 1, 1971 to July 1, 1977," and "Table 3. Components of Change — April 1, 1970 to July 1, 1977" (Sacramento, n.d.). (Mimeo)

7. Association of Bay Area Governments (ABAG), "Provisional Series 3 Projections: Population, Housing, Employment, and Land Uses — San Francisco Bay Region" (San Francisco: ABAG, March 1977). These data are by "440 zone" rather than by census tract. But because 440 zones are agglomerations of census tracts (usually 2 to 4 census tracts constitute one 440 zone), the 440 zone data could be readily converted to conform to the selected census tracts with a minimum of interpolation.

8. For 1975, the corresponding 440 zones were used.

9. Association of Bay Area Governments, untitled mimeo showing demographic data by 440 zone.

10. U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States — 1976 (Washington, D.C.: U.S. Government Printing Office, 1976), Tables 652 and 664.

11. The four areas are Fruitvale (Oakland), downtown Berkeley, downtown San Francisco, and South Shore (Alameda).

again adjusted upward (by a factor of 1.08, or half the previous adjustment) to compensate for the high proportion of single-person households.

Initial sales volume of the sampled stores was obtained directly from the 1970 survey figures. We hypothesized that larger stores would experience more growth than smaller stores. Store size in terms of sales volume was expressed by taxable retail sales per store.

Major transportation developments near the center, other than BART, were also included in the regression, based on the hypothesis that such transportation improvements could increase patronage and induce higher growth in sales for nearby stores. The number of freeways constructed within one-half mile of the center from 1971 to 1976 was selected as the measure of this factor.

Competition from new stores was thought to be negatively associated with growth in sales. It was indicated by the number of large retail stores (department or discount stores) built between 1970 and 1976 and located within 3 miles of the center.

Least squares regression analyses were performed on the large-store and the all-store samples, utilizing the Time Series Processor (TSP) program developed by Robert E. Hall.[12] The results, presented later in this paper, led us to refine our distance measure by requesting the State Board of Equalization to reaggregate the data for downtown San Francisco, Oakland, and Berkeley. (These three areas were selected because they had the greatest number of sampled stores and because they represented three of the four largest cities in the service area.) The earlier samples contained a wide variation in distance from BART within each set of five or six stores. We reasoned that if BART were having an effect on sales in these areas, and if the effect diminished rapidly with distance from the station, then the variation within each set could easily mask any BART effect. The stores within each revised set were much more uniform in terms of distance to BART, and the store-size distinction was improved. The reaggregation resulted in ten large-store sets and twenty-five sets of smaller stores. Least squares regression analyses (via the TSP program) were then performed on the new groups.

LIMITATIONS OF THE ANALYSIS

Survey of Shoppers

The shopper survey was implemented at six shopping locations, all with BART access. Respondents were screened so that only those on shopping trips or errands and who had lived in the BART service area at least since 1974 were included. Thus, the sample is a random sample of a certain subset of the general population, i.e., the set of people who were in the study areas during the survey

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12. Robert E. Hall, "TSP — Time Series Processor Basic User's Manual" (Berkeley: University of California Berkeley, Department of Economics, January 1968). (Rev. February 1970)

and who met the screening criteria. Since there is no definitive information on the incidence of people throughout the population who belong to the subset, statistical inference regarding the general population cannot, strictly speaking, be made from the present sample data. Although we have no information which would lead us to believe that the BART-user characteristics of our sample differ from those prevailing in the general public, neither can we confirm that these characteristics are parallel.

BART began permanent Saturday service on November 19, 1977, and the survey was conducted in late November, 1977. Therefore, people surveyed had not yet had a chance to establish any new Saturday shopping patterns because of BART. The survey, then, addresses only BART's weekday effects on shopping and may understate BART's full effect.

Key Informant Interviews

The primary limitation of the key informant interview technique lies in the fact that it is inherently subjective. Not only does it necessarily rely on the informants' perceptions of BART's influences and on his ability and willingness to communicate these perceptions, it also relies on the interviewer's ability to probe and understand the informant's perceptions. Concerning the informants' perceptions, it is pertinent to note that the initial "selling" of BART before the referendum in 1962, together with BART's subsequent public relations efforts, may have generated many preconceptions about what effects the system would have. We were concerned that informants' sense of BART has continued to be influenced by these early popular opinions rather than by the actualities of BART's operation. Therefore, we used great caution before accepting speculative answers to our questions about BART's effect on location decisions and sales, which were not supported by specific facts.

We found that informants were often unable to articulate the relative importance of the many factors which enter into a location decision. Many informants were able to list the most important factors in their decision but could not rank them. Therefore, our conclusions about BART's effect on location decisions are sometimes limited to whether BART was included among the most important considerations.

Finally, even if a store has experienced a change in sales, it is very difficult to attribute that change to BART or to any other specific factor. Therefore, answers to this question are only evaluated in relation to the results of our sales tax data analysis.

Sales Tax Data Regressions

Values for the dependent variable in the regressions were calculated from sales tax data compiled by the California Board of Equalization under the initial direction of Louis P. Bucklin.[13] These data, collected from 1970 through 1976,

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13. Louis P. Bucklin, BART-II, Part IV, Impact on Retail Sales, IURD, University of California, Berkeley, 1973.

have several shortcomings:

1. Not all major shopping areas are included. The sample contains seventeen shopping areas, eight of which are planned shopping centers. These constitute the bulk of the shopping areas in the BART service area, but do not include all of them (the most notable omission is Hilltop Shopping Center located in Richmond, which opened in 1976).

2. Not all retail sales are taxable, so certain types of stores are not included in the analysis. Food (aside from food at restaurants) and optical supplies are among the non-taxable retail items. Fast food outlets were not taxable before 1972 but are now.

3. The years of analysis do not adequately cover the pre-BART period. Data collection began in 1970, while BART construction in most areas began between 1967 and 1969.

4. In order to preserve confidentiality, sales data were available only for groups of, on the average, five or six stores. Therefore, any individual store's sales could not be followed through time.

5. The unit of analysis was the initial, randomly selected retail address, not the individual firm. This step was necessitated by the very high turnover rate observed in the first two years of data collection. Adherence to the firm as the unit of analysis would quickly have resulted in a vastly reduced sample, biased toward stable, long-standing stores. Using the address as the unit of analysis, however, did not eliminate all problems. When turnovers occurred, the replacement stores were frequently of a very different nature than the predecessors. Consequently, the retail sales could vary considerably when a new store took over. Secondly, stores were dropped from the sample when a site was vacated or converted to a different use (such as a non-retail business, or a store whose items were nontaxable). In some cases enough sites became vacant or had non-retail uses that sets had to be combined to retain enough stores to maintain confidentiality of sales. Except for the "large store" sets, no procedure was incorporated into the study to handle this problem of decreasing sample size.

6. Data validity problems also occurred. The supposedly fixed addresses were changed by the Board of Equalization in several instances when a building was demolished or a store moved, even if a different retail outlet occupied the vacated space. This was not done in any systematic manner, but seemed to occur haphazardly over the years. A separate problem was that in instances when a retail company had more than one outlet in a community, separate sales figures were not always reported to the Board of Equalization for the outlet near BART. In such cases sales were split evenly among the outlets.

   The reader should take into account the above-described changes in the initial sample when assessing the reliability of the results reported later. We feel that although problems are not inconsequential, the data are sufficiently meaningful to warrant analysis and that the findings based on them have value.

The regression analysis itself is an oversimplified model of the real world. For example, the impacts of nearby redevelopment projects are not clearly under-

stood and are not specified in the regression, nor are differential impacts of changing gasoline prices, nor the effects of changing racial characteristics of the market populations. Also, when it occurred, multicollinearity among the "independent" variables in the regression analysis seriously weakened our ability to identify significant explanatory agents.

3. FINDINGS - BART'S EFFECT ON RETAIL SALES AND SERVICES

The pattern of retail sales in the three-county BART service area has shifted substantially over the past twenty years. While the three major central business districts of San Francisco, Oakland and Berkeley accounted for 20 percent of the region's retail sales in 1958, by 1972 their share had dropped to only 10 percent. The shift has favored the rapidly growing suburbs on the periphery of the area. Shopping centers in San Leandro (Bay Fair) and Walnut Creek (Broadway Plaza), for example, gained sales volumes of 95 percent and 71 percent, respectively, between 1963 and 1972. In the Sun Valley Shopping Center in Concord, the increase is even more striking: from 1967 to 1972 sales increased 196 percent, making Sun Valley the region's largest planned shopping center. In contrast, from 1963 to 1972 sales in San Francisco's, Oakland's, and Berkeley's central business districts gained 12 percent, fell 10 percent, and gained 23 percent, respectively.[14]

These figures indicate that a major shift has occurred in retail sales. More and more stores are opening in the suburbs to be near consumers, foresaking the traditional downtown areas. Consumers have obviously responded enthusiastically to the new suburban locations. New stores and shopping centers almost universally locate near freeways, demonstrating the importance of good automobile access as a location criterion. If BART serves to significantly increase access to consumers, and if consumers value the accessibility improvement, BART's effect should appear in consumer shopping pattern changes and, hence, in retail sales pattern changes. Also, one might expect retailers themselves to be aware of BART's effect and consider it in their location decisions.

HYPOTHESIS 1: People's choice of locations for shopping and other services has favored establishments in shopping areas served by BART.

Since BART has increased consumers' accessibility to the shopping areas where the survey was administered, we postulated that consumers who took advantage of BART might have increased their frequency of shopping at these centers more so than shoppers who did not ride BART. This effect was measured in two ways: first, by comparing the number of BART riders who have increased their patronage of a shopping area with the number of non-BART riders who have done so; and second, by comparing the frequency of visits by the BART riders with the frequency of visits by the non-BART riders. These two approaches are incorporated into the first two specific hypotheses.

Hypothesis 1-A: Shoppers who ride BART have increased their patronage of shopping areas with BART access, in relation to shoppers who do not use BART.

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14. All retail sales data in this paragraph are from U.S. Department of Commerce, Census Bureau, Census of Business and Manufacturers, Major Retail Centers — California, 1958, 1963, 1967, and 1972 (Washington, D.C.: U.S. Government Printing Office), and are expressed in current dollars.

The survey data do not support this hypothesis. We divided the sample into two sets, one consisting of persons who rode BART to the shopping area, and the other consisting of those shoppers who did not ride BART. Using a T-test, we found no significant difference[15] between the two groups in the proportion of each group reporting increased use of the shopping area. About sixty percent of both groups responded that they had increased their use of the surveyed shopping area since 1974.

Hypothesis 1-B: Shoppers who ride BART shop more frequently at shopping areas with BART access than do shoppers who do not ride BART.

This hypothesis is also unsupported by the survey data. Examining the same two groups as in Hypothesis 1-A (BART riders and non-BART riders), we found no difference in frequency of trips to the surveyed shopping areas. Both groups visited the surveyed shopping areas about eight or nine times per month. The conclusion we draw from these two results is that BART is not having a significant effect on people's use of existing shopping areas.

Hypothesis 1-C: BART is an important inducement for shoppers who ride it to increase their shopping in areas with BART access.

Of the 177 respondents who had increased their use of the shopping areas surveyed during the past three years, 44 (25 percent) volunteered BART as a reason for having increased their use of the area where they were surveyed. The respondents' reasons for increasing use of the shopping areas surveyed are tabulated in **Table 1** on the following page.

BART appears from the results shown in Table 1 to have been a substantial factor in people's increased use of BART-accessible shopping areas. However, because BART riders do not show a greater frequency of use than do non-BART riders, BART's influence cannot be considered to be very important to shoppers as a group. BART's importance may be greater for particular subgroups, such as those without access to private vehicles.

A major concern of this study is to try to detect any BART-induced shift in shopping patterns within the three-county BART service area. The next two hypotheses are directed to this effect. In the first, we postulated that BART-improved accessibility in the central cities has attracted shoppers who never shopped in the central cities before BART. In the second, we postulated that BART has improved the accessibility to the suburban shopping centers located near BART stations, and that this improved accessibility has drawn shoppers to these areas. The two effects are not necessarily inconsistent; it is possible for shoppers to be drawn both to central city shopping areas and to large suburban shopping centers, at the expense of smaller local shopping areas.

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15. The 5 percent level of significance was used for statistical tests throughout this study.

TABLE 1. SURVEY RESPONDENTS' REASONS FOR INCREASING USE OF SHOPPING AREA

Reasons for Increasing Use of Shopping Area	Percent of Respondents Who Increased Use
Work or live in area now	26
Can use BART	25
Improved shopping in area	21
Other improved public transportation	7
Personal reasons (e.g., friends in area)	6
Other areas less attractive	1
Other	18
No answer	2
TOTAL	106[a]

SOURCE: David M. Dornbusch & Company, Inc. 1977 Shopper Survey.

a. Total does not equal 100 percent because some respondents gave multiple reasons.

Hypothesis 1-D: Shoppers who ride BART have shifted their shopping patterns to the older, BART-served downtown areas of San Francisco and Oakland.

This hypothesis was tested for all four older downtown areas surveyed: San Francisco's downtown and Mission District, Oakland, and Berkeley, and was supported to a limited extent by the data in downtowns San Francisco and Oakland.

The survey sample was split into two sets: those respondents who have shopped in the area in question at least since 1974, and those who began shopping in the area after 1974. The set of shoppers who began shopping in San Francisco after 1974 showed a significantly higher propensity to use BART than did the set who had shopped in San Francisco from before 1974 (73 percent versus 60 percent). New shoppers in Oakland showed a similarly higher propensity to use BART (67 percent versus 52 percent). In the Mission District and Berkeley, however, there was no significant difference in BART usage between those who recently began shopping and those who had shopped there from before 1974. (See **Table 2**, on the following page.)

Further analysis of the survey results for downtown San Francisco and Oakland revealed that the magnitude of the impact was small in terms of all shoppers. But when only new shoppers were considered, the effect in downtown San Francisco was substantial. As **Table 3** (on page 22) demonstrates, fewer than five percent of all shoppers surveyed in each location responded that the

TABLE 2. PROPENSITY TO RIDE BART TO DOWNTOWN SHOPPING AREAS -- NEW SHOPPERS VERSUS LONG-TERM SHOPPERS

Shopping Area	Percent of Shoppers Surveyed Who Used BART to Travel to Shopping Area	T-Test Level of Significance
San Francisco		
- new shoppers[a]	73	.035
- long-term shoppers[b]	60	
Oakland		
- new shoppers	67	.049
- long-term shoppers	52	
Mission District		
- new shoppers	50	*
- long-term shoppers	58	
Berkeley		
- new shoppers	58	*
- long-term shoppers	49	

SOURCE: David M. Dornbusch & Company, Inc. 1977 Shopper Survey.

NOTE: * indicates results were not significant at the 5 percent level.

a. Persons who began using the shopping area since 1974.

b. Persons who began using the shopping area in or before 1974.

access provided by BART was their reason for beginning to shop in that area. But, more than 40 percent of the new shoppers surveyed in downtown San Francisco stated that BART had enabled them to use the area. (Because of the small number of observations, and the sample weighting procedures, however, further research may be necessary to confirm this finding.)

The key informant interviews are compatible with the findings. Four of the five informants reporting some increase in sales which is attributable at least partially to BART are located in downtown San Francisco or downtown Oakland. (C-19, C-24, C-29, and C-35)[16] One informant in the Mission District also reported a BART-induced sales increase. (C-30)

16. Letter-number combinations in parentheses refer to the Appendix and informant number, respectively, of the source for the preceding information.

TABLE 3. BART'S INFLUENCE ON NEW SHOPPERS IN DOWNTOWN SHOPPING AREAS

	Downtown San Francisco	Downtown Oakland
Percent of all shoppers surveyed in each area citing BART as reason for beginning to shop there	3.7	2.3
Percent of new shoppers surveyed in each area citing BART as reason for beginning to shop there	42.9	16.7
Number of new shoppers surveyed	7	12

Hypothesis 1-E: Shoppers who ride BART have shifted their shopping patterns to the outlying shopping areas served by BART, such as El Cerrito Plaza and Walnut Creek.

This hypothesis was tested in the same manner as Hypothesis 1-D. Results showed that new shoppers in Walnut Creek exhibit a significantly higher propensity to ride BART than do established shoppers. In El Cerrito Plaza, however, no difference was observed between new shoppers and established shoppers. See **Table 4.**

TABLE 4. PROPENSITY TO RIDE BART TO SUBURBAN SHOPPING AREAS - NEW SHOPPERS VERSUS LONG-TERM SHOPPERS

Shopping Area	Percent of Shoppers Surveyed Who Used BART to Travel to Shopping Area	T-Test Level of Significance
Walnut Creek		
- new shoppers[a]	69	.000
- long-term shoppers[b]	29	
El Cerrito Plaza		
- new shoppers	55	*
- long-term shoppers	50	

SOURCE: David M. Dornbusch & Company, Inc. 1977 Shopper Survey.

NOTE: * indicates results were not significant at the 5 percent level.

a. Persons who began using the shopping area since 1974.

b. Persons who began using the shopping area in or before 1974.

Further analysis of the survey data showed that 10.0 percent of the shoppers surveyed in Walnut Creek cited BART as the reason for beginning to patronize that shopping area. This amounted to almost one-half (47.1 percent) of the new shoppers surveyed in Walnut Creek, and is an important BART impact. (Note, however, the same limitations expressed for the previous hypothesis. The number of new shoppers surveyed was 17.)

One key informant suggested that a significant number of shoppers were riding BART to Walnut Creek, then using the shuttle bus between the BART station and Broadway Plaza, the town's biggest shopping area. (F-9) Moreover, Walnut Creek's Bus Coordinator reports an average of about 500 trips per day between the BART station and downtown Walnut Creek (which includes Broadway Plaza).[17] This shows considerable traffic between BART and the town's shopping district, even though it is not clear how many of these trips are made by shoppers.

In contrast, the Institutions and Life Styles Project case studies found that most Walnut Creek merchants surveyed felt that BART had transferred more retail trade to San Francisco and Oakland than it had brought in from outlying areas. The 1976 Passenger Profile Survey supports their observation: for each 38 shoppers taking BART to Walnut Creek, 93 were found to take BART from Walnut Creek to shop in some other area.

Another major study purpose was to investigate whether BART has affected the shopping behavior of different socio-economic groups in different ways. We postulated that transportation disadvantaged groups would be more likely to ride BART for shopping trips than would other people. It was also postulated that people who have had a recent (within three years) change in marital status might be changing other aspects of their lifestyle and might therefore be more likely than the average person to use BART on shopping trips. Finally, because BART is said to cater generally to commuters who are white, middle income people, we postulated that people who use BART for shopping might show the same characteristics. Therefore, we tested our sample to see whether people in different ethnic groups or with different education levels showed different tendencies to use BART.

These concerns are reflected in the following hypothesis:

Hypothesis 1-F: BART provides shopping transportation more for the following groups of people than for others:

a. Youths (aged 19 or less)
b. Aged (age 60 or more)
c. People without access to private vehicles
d. Minorities
e. Unmarried people
f. People who have had a recent (within three years) change in marital status
g. Lower income people
h. Less educated people

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17. Telephone conversation with Mr. Ronald Arrington, 27 February 1978.

Testing the percentage the above people used BART for shopping in the surveyed areas against the percentage that the rest of the sample population used BART, we found three categories of people who used BART a significantly higher proportion of the time: youths, people without access to private vehicles, and unmarried people. The percentage of time each subgroup used BART as opposed to other transportation for shopping in the area in which they were surveyed is shown in **Table 5.** These findings appear to indicate that, except for low income groups, transportation disadvantaged people rely on BART to a greater extent than the general population.

Access to a private vehicle is of course a direct measure of transportation disadvantage, but we found that income and marital status are also indications of transportation disadvantage. According to the shopper survey, only 32 percent of those earning less than $7,000 per year had access to a car, while 59 percent in the $7,000 to $15,000 category and 83 percent earning over $15,000 had access to a car. Fewer than half of those who were widowed, divorced, or never married had automobile access, while about 78 percent of the married and 79 percent of the separated persons did have access. Interestingly, although age was found to be independent of access to a vehicle (Chi-square - 18.5, df = 11), the data in Table 5 show that young people tend to use BART more frequently than others.

The data in Table 5 fail to support the hypothesis that people with a recent change in marital status would ride BART more than average. We observed no significant difference among the sample according to change in marital status. Our postulate that BART ridership would differ according to ethnic, income and education characteristics was also unsupported by the data. We found no significant difference in BART use according to these characteristics.

The next set of issues investigates how people's origins, destinations, and travel habits influence their propensity to use BART to shop. Because the greatest use of BART is for commuting, we postulated that many BART riders would stop to shop while going to or from work, and so be more likely than others to use BART on shopping trips. Because people who work in transit-oriented areas, such as downtown San Francisco and Oakland, are probably more familiar with all kinds of public transit, we postulated that these people might be more likely than others to use BART for shopping trips. Finally, shoppers who must commute relatively long distances to work may not only be more familiar than the average person with public transit, but may also have more extended shopping horizons than usual; i.e., they may be more familiar with and shop more frequently at distant shopping areas than people who do not commute long distances. Therefore, they may travel longer distances to shop and may be more likely to use BART for those trips. These three issues are embodied in the following three hypotheses.

Hypothesis 1-G: People stopping to shop on the way between home and workplace are more likely to use BART than are people on a shopping trip to and from home.

It was hypothesized that people on trips to and from work are more transit-oriented than are people on other types of trips, that BART would have a greater impact on their work trips than on other trips, and that this difference would be reflected

TABLE 5. SOCIO-ECONOMIC DIFFERENCES IN SHOPPERS' USE OF BART

Socio-Economic Characteristic	Frequency of BART Use On Shopping Trips to Area Where Respondent Was Surveyed (in percent)	T-Test
Age 19 or less	57	.012
Age over 19	42	
Age 59 or less	45	--[a]
Age over 59	41	
People without access to private vehicles	50	.007
People with access to private vehicles	40	
Minorities	42	--[a]
Whites	44	
Unmarried people	47	.049
Married people	40	
Recent change in marital status	43	--[a]
No change in marital status	47	
Income		
None	23	--[b]
Less than $ 5,000	41	
$ 5,000 - $ 7,000	60	
$ 7,000 - $10,000	39	
$10,000 - $15,000	49	
$15,000 - $20,000	44	
$20,000 - $25,000	48	
$25,000 - $50,000	38	
More than $50,000	39	
Education		
No formal schooling	25	--[b]
8th grade	44	
9th - 11th grade	47	
High school graduate	47	
Trade school	38	
1 year college	43	
2 - 3 years college	46	
College graduate	40	
Post-graduate education	32	

SOURCE: David M. Dornbusch & Company, Inc. 1977 Shopper Survey.

a. Not significant at the 5 percent level.

b. Income and education were tested with the Chi-square distribution and both were found unrelated to BART ridership.

by a higher BART ridership among those shopping on the way to or from work than among those on a shopping trip directly from home. However, the sample data do not support this hypothesis. The hypothesis was tested by comparing the percentage of respondents using BART to arrive in the survey area who were traveling to and from home with the shoppers who had used BART and who were traveling between home and workplace. We found no statistically significant difference between the two groups. In fact, the test results showed that almost identical proportions of shoppers on home-to-home trips and on home-to-workplace (or workplace-to-home) trips had used BART (46 percent and 47 percent, respectively). Of those sampled, 8.9 percent were shopping on their way home from work, 4.6 percent on their way to work.

Hypothesis 1-H: Shoppers who work in transit-oriented areas (downtown San Francisco and downtown Oakland) are more likely to use BART for shopping than are shoppers who do not work in transit-oriented areas.

This hypothesis was also not supported by the survey data. We found no difference in BART ridership between those with central city workplaces and those with suburban workplaces. Workplace location appears to make no difference in BART use on shopping trips among our sample population.

Hypothesis 1-I: Shoppers who are relatively long-distance commuters are more likely to use BART for shopping than are shoppers who are not long-distance commuters.

A test of our sample data supports this hypothesis. The survey recorded nine home and workplace zones within the BART service area (see **Appendix A**). We defined those individuals with a home in one zone and workplace in another zone as long-distance commuters. People with home and workplace in the same zone comprised the second group. The long-distance commuter group showed a significantly higher use of BART to arrive in the survey area on the day they were surveyed, and a significantly higher frequency of BART use to shop in the survey area. **Table 6** (on the following page) summarizes these results.

The greater propensity to use BART shown by the long-distance commuters might be explained by their greater familiarity with the BART system, which might make them use it more readily than a local commuter who seldom if ever rode BART.

The final issue tested by the survey data was how propensity to use BART on shopping trips is affected by the specific purpose of the shopping trip. We postulated that persons on errands for services (such as dentist appointments or banking visits) or shopping for highly portable personal items like clothing would be much more willing to ride BART than would persons shopping for heavy or bulky items like groceries. If this phenomenon were observed it would not only partially explain why some people ride BART and others do not, but it would also help to indicate the type of service and retail firms which might successfully locate near BART stations, and provide an important context for the key informant interviews.

TABLE 6. BART USE ON SHOPPING TRIPS BY LONG-DISTANCE COMMUTERS AND BY LOCAL COMMUTERS

	Long-Distance Commuters	Local Commuters	Value Of T-Test
Percentage of respondents who arrived in the survey area on BART	58	42	.022
Frequency respondents use BART to shop in the survey area (in percent)	57	36	.002

SOURCE: David M. Dornbusch & Company, Inc. 1977 Shopper Survey.

Hypothesis 1-J: People shopping for personal items or who are on a personal errand are more likely to ride BART for that purpose than are those who are shopping for bulky items.

This hypothesis is supported by the survey data. For each type of shopping trip (groceries, personal items, household items, household appliances, household furniture, personal errand and Christmas shopping), we determined whether the people on that type of trip were more or less likely to ride BART than were people on all other types of shopping trips. We found that people on personal errands (such as dentist appointment or a banking visit) showed a significantly higher propensity to use BART than did all other shoppers. As expected, people shopping for groceries or for household appliances showed a significantly lower propensity to use BART. **Table 7** (on the following page) presents these findings.

These results indicate that firms providing personal services may benefit the most from BART and that firms selling household appliances or furniture may benefit the least. This issue will be addressed further in the discussion of Hypothesis 2.

HYPOTHESIS 2: Location decisions for retail establishments and other population-oriented services favored sites that gained improved accessibility to clients' dwellings, workplaces, or other activity centers as a result of BART.

We found from interviewing key informants that BART has been almost completely disregarded as a location decision factor for new retail stores and service facilities. Of the 20 informants from retail and service firms who would articulate their location decision criteria, 16 said that access to customers was of paramount importance. The informants felt that proximity to good transportation facilities was important in gaining access to their customers: 15 rated transportation facilities among their top three criteria. BART, however, was not

TABLE 7. PERCENTAGE OF SHOPPERS SURVEYED WHO ARRIVED ON BART, ACCORDING TO TYPE OF SHOPPING TRIP

Type of Shopping Trip	Of All Shoppers Surveyed, Percent of Shoppers on Specific Types of Shopping Trips Who Used BART	Of All Shoppers Surveyed, Percent of Shoppers on All Other Types of Shopping Trips Who Used BART	T-Test
Groceries	34	51	.006
Personal items	46	51	--[a]
Household items	52	49	--[a]
Household appliances	23	50	.028
Household furniture	29	49	--[a]
Personal errand	58	44	.002
Christmas shopping	48	50	--[a]

SOURCE: David M. Dornbusch & Company, Inc. 1977 Shopper Survey.

a. Not significant at the 5 percent level.

considered a very important aspect among transportation facilities. Using the following ranking system, stores were asked to assign levels of importance to their location criteria:

1 = not important enough to sway a decision

2 = possibly important enough to sway a decision

3 = definitely important enough to sway a decision

According to this system BART seldom ranked very high and fared poorly against alternative forms of transportation. Among the 10 stores locating in urban areas, the mean rank given bus accessibility was 2.0, while BART's mean rank was 0.9, and automobile accessibility ranked 1.2. Among the 8 stores locating in the suburbs, the mean rank of automobile accessibility was 3.0, while BART ranked 1.0 and busses ranked 0.5. These simple figures clearly indicate that automobile accessibility is thought to be critically important in the suburbs and that busses are the most favored means of transportation in the central cities.

Because BART is a relatively insignificant location criterion, few stores would have located differently had BART not been built. Twenty-five informants claimed that their locations choices would have been the same in the absence of BART. Two informants said their locations might have differed, but in both cases special circumstances influenced the decisions. One case was Citizens Savings and Loan, which located a new branch in Oakland's City Center Project, with a plaza level entrance to the 12th Street and Broadway BART Station. The City Center Project is a redevelopment project which relied on BART for local financing, and which would not have been built on the same scale, at least, without BART. If BART had not been built, therefore, Citizens Savings and Loan would not have

located a new office at that location. (F-5) (However, the Grove-Shafter freeway has been another significant decision variable in the City Center Project. Department stores have been unwilling to commit themselves to the Project until completion of the freeway was guaranteed. (E-9))

The second case involves Crocker National Bank, which also located a new branch in the Oakland City Center Project and for the same reason was strongly influenced by BART. Crocker was also affected by BART in San Francisco's Mission District. Crocker had a branch at 16th and Mission Streets which existed before BART. BART's line runs underground through the Mission District and their 16th Street Station was constructed directly underneath Crocker's old branch, taking Crocker's basement. In order to provide the space necessary for the branch, and because Crocker wanted to retain a branch in the Mission District, Crocker built a new branch at the 16th and Mission Street site. (C-10)

Both Citizens Savings and Loan and Crocker National Bank provide their customers with financial services and therefore represent the type of firm described in Hypothesis 1-J to be most likely to gain customers from BART's improved accessibility, but neither firm located its new branches specifically to be near BART.

If more firms believed that BART's proximity improved their sales, then more would be likely to consider BART in their location decisions. Of the 33 informants who had an opinion of whether BART was influencing their sales, 6 said they believed BART was helping, and 27 said they thought BART had no effect. Of the six stores we interviewed which said that BART was helpful, two were in downtown San Francisco, two were in downtown Oakland, one was in the Mission District, and one was in Lafayette. (C-19, C-24, C-29, C-30, C-35, E-2)

Four informants discussed the reasons why stores left locations near BART stations. One furniture store in the Mission District left because "their regular clientele moved away" and because during BART construction "people no longer drove by the store." (C-33) At least part of the store's decline may be attributable to BART's construction phase disruption, an effect that will be discussed further in another Work Element of the Land Use and Urban Development Project, "BART's Construction Effects." None of the other stores claimed that BART had been a reason for their leaving the area. (C-1, C-28, C-31)

Even though BART has not proved to be an important location consideration, stores which are located near BART attempt to exploit that proximity as much as possible. Seventeen stores mention their proximity to BART in their advertising, and three have changed their hours in an attempt to cater to BART riders.

Many retail store employees regularly ride BART to work. As might be expected, employee ridership drops considerably with increasing distance to the nearest BART station. About one-third of the employees of stores located within one block of a BART station ride BART, based on a sample of nine stores that responded to the question. About 20 percent of the employees of stores located one to four blocks from a BART station ride BART, based on a four store sample. Almost no employees of the two stores interviewed which were located farther than four blocks from a BART station ride BART. BART's later opening on Saturdays (9 a.m.) prevented employees of at least two major retail stores from using the system. (C-3, C-17)

Employee use of BART appears to be increasing only for the stores nearest a BART station. Three of the six stores located within one block of a BART station and answering the question, said that employee use of BART was increasing. Only one of four firms located from one to four blocks from BART said that employee use of BART was increasing. The single firm which was located farther than four blocks from BART and which answered the question said that employee use of BART was declining.

Job applications from minorities may be increasing somewhat because of BART. Of sixteen firms answering the question, five said they believed that the improved accessibility afforded by BART was increasing the number of job applications they received from minority applicants, while eleven said they felt BART was having no effect. If BART is having any effect it appears to be related to the store's proximity to the nearest BART station: four of the five firms which have observed an increase in minority applicants are located within one block of a BART station.

No store has so far reduced the number of parking spaces it has provided its customers or employees because of its proximity to BART. In fact, the closer the store is to a BART station, the more likely BART has disrupted its parking arrangements: six informants reported that their stores had experienced problems with BART riders' cars overflowing BART parking lots into their own. (C-8, C-20, E-3, E-24, E-25, E-26, E-32)

HYPOTHESIS 3: The distribution of retail sales shifted toward commercial areas within walking distance of BART stations and sites along the pedestrian routes leading to the BART stations.

To investigate whether BART has induced increases in sales in nearby areas, retail sales in seventeen Bay Area locations[18] were examined from 1970 through 1976. A total of 98 sets of approximately five or six stores were studied. Walking distance to the nearest BART station was included with several other variables (change in income and population in the surrounding area, new freeway construction, competing stores, and initial sales volume) in least squares regressions of the dependent variable, change in retail sales per store. Two groups of data were independently analyzed, one sample representing each area's largest stores (16 sets) and therefore most of its sales, and the other including a sample of the large stores and many smaller stores (82 sets).

Four different distance measures were tested in the regression equations. For the large stores, the most stable distance measure, in terms of standard error of the associated regression coefficient, was the proportion of stores in the set located within 1,500 feet of a BART station. (D4) For the other group of stores, the proportion of stores within 600 feet of a BART station was most stable. (D3)[19]

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18. Bay Fair, Berkeley, Concord, El Cerrito Plaza, El Portal, Fremont Fashion (no large stores), Fremont Hub, Fruitvale (in Oakland), Hayward, Oakland, Richmond, San Francisco, San Leandro, Southland, South Shore, Sun Valley, and Walnut Creek.

19. According to the gravity model, this is what one might expect; the larger stores exercise an influence over a larger area than the smaller stores.

(The other two measures studied were the mean and the mean of the square roots of the distances.) The entire estimated regression equations are shown in Appendix G.

For the large-store sample, the large standard error of the coefficient for D4 does not allow us to reject the null hypothesis that sales have not shifted to BART, using a one-tailed t-test at a .95 level of significance; i.e., $H_o: b_{D4} \leq 0$. In the mixed sample, however, a one-tailed t-test of the D3 coefficient (b_{D3}) rejects the null hypothesis $H_o: b_{D3} \leq 0$ at the .95 level.

Graphical analysis of the residuals for both equations gave no reason to suspect that the assumptions about random distribution and homoscedasticity of the error term were violated. However, the variance-covariance matrices of the regression coefficients (and the associated correlation matrices) indicate a possibility of moderate multicollinearity between the adopted distance measures and some of the other explanatory variables. (Specifically, between D4 and POPP and D3 and POPP).[20] Not only does this make it potentially impossible to separate the effects of BART, but multicollinearity may also introduce large errors in the coefficient estimates and make the sampling variances of the coefficients very large. Therefore, the failure to reject the null hypothesis in the large-stores-only sample might very well be due to imprecision and large sample variances introduced by multicollinearity. Likewise, the potential error in the coefficient estimate in the latter sample also makes the result of the test (null hypothesis rejected) suspicious.

To test whether the multicollinear population and distance factors together constitute a significant influence on retail sales, the following test was applied:[21]

$$\frac{1}{q}(b^* - b)^1 V^{*-1}(b^* - b) > F_{q,T-m}(\alpha)$$

where
- q = number of coefficients under test
- b^* = vector of estimated coefficients under test
- b = vector of hypothesized coefficients under test
- V^* = estimated covariance matrix of the coefficients under test
- T = number of observations
- m = total number of exogenous variables, including the constant

The calculated value of the test statistic in the large-store sample was found to be .727, which does not exceed $F_{2,11}(.05) = 3.98$. In the mixed sample, the test statistic was 2.827, which does not exceed $F_{2,77}(.05) = 3.13$.

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20. The matrices are included with the estimated regression equations in Appendix G.

21. E. Malvinaud, Statistical Methods of Econometrics (Amsterdam: North-Holland Publishing Company, 1966), p. 203.

Therefore, further analyses were carried out on reaggregated sets of retail sales data for downtown San Francisco, Oakland, and Berkeley. The stores were regrouped more accurately by distance to BART and by store size than in the previous samples. For each city, the categories are shown below. Note that in contrast to the first aggregations, the reaggregations are formed by two mutually exclusive groups (small stores and large stores) which can be combined without doublecounting any observations.

I. Stores with annual sales over $500,000 and

   (a) within 400 feet walking distance of the nearest BART station
   (b) 401 to 1,000 feet from BART
   (c) over 1,000 feet from BART

II. Stores with annual sales under $500,000 and

   (a) within 100 feet walking distance of the nearest BART station
   (b) 101 to 300 feet from BART
   (c) 301 to 600 feet from BART
   (d) 601 to 1,000 feet from BART
   (e) 1,001 to 1,500 feet from BART
   (f) 1,501 to 2,000 feet from BART
   (g) over 2,000 feet from BART

These reaggregations produced ten sets of large stores and twenty-five sets of small stores. Each set fell entirely within one of the categories shown above.

Three measures of distance to BART were applied in the regression equations for these data. As before, the mean distance of all the stores in each set from the nearest BART station was one measure employed. The other two measures were refinements of earlier measures: the proportion of the stores in each set which lay within 150 feet of a BART station, and the proportion of stores which lay within 300 feet of a BART station. Of the three measures studied, the proportion of stores in each set within 300 feet of a BART station (called D7) proved to yield the most stable results.

On the sample of large stores (sales exceeding $500,000), a test of the null hypothesis, $H_0: b \leq 0$, where b is the coefficient for D7, did not allow its rejection at the .05 level. The residuals, analyzed graphically, indicated no cause to suspect that the assumptions concerning distribution of the error term were violated. However, strong collinearity was found between D7 and the measure of initial store volume (VOL) and to a lesser extent between D7 and the measure of growth in income (INC). Once again, possible BART effects could not adequately be separated from the effects of other factors. When the joint effects of D7 and VOL were examined using the previously described test, they were found to be significant at the .05 level. Thus, one can say with 95 percent confidence that proximity to BART together with a store's initial sales did affect growth in sales. Because both coefficients are negative (see Equation 4, Appendix E), we presume that the combined effects were negative ones, i.e., that larger,

near-BART stores tended to suffer declining real sales during the period from 1970 to 1976. This finding lends no support to our hypothesis of positive BART effects. The reader is referred to Appendix G for further analysis of this relationship.

No regression equation was found to adequately explain the variation in the reaggregated data for small stores only. The combined group of large and small stores, however, can be satisfactorily described by **Equation 1.**

EQ. 1	B =	- .0225VOL	+ 2.44POPP	+ .0526INC	- 21.2D7	+ 42.5
(t-statistic)		-20.642*	1.215	.143	-1.954*	1.811*

R^2 = .94

$F_{(4,30)}$ = 123.8

n = 35

where B = estimated real growth in retail sales, 1970 to 1976

VOL = initial sales volume per store

POPP = population change in primary market area, 1970 to 1976

INC = change in income in the primary market area, 1970 to 1976

D7 = proportion of stores within 300 feet walking distance of a BART station

*Asterisk denotes significance at the .05 level.

Again, the null hypothesis that the coefficient of D7 was less than or equal to zero could not be rejected.[22] However, this time the distance measure was not found to correlate highly with any other coefficients in the equation, and graphic analysis of the residuals gave no cause to suspect that assumptions of random distribution of error were violated. Thus, in this case we can reject with a .95 level of confidence the hypothesis that proximity to BART had a positive effect on retail sales from 1970 through 1976.

In summary, regression analyses applied to all retail sales data from seventeen Bay Area locations have failed to reject the null hypothesis that BART has not shifted shopping patterns toward stores near BART stations. The failure to reject, though, might well be influenced by multicollinearity. However, separate analysis of the three major downtown shopping areas—San Francisco, Oakland and Berkeley—enabled us to reject the hypothesis that stores there had experienced increases in sales from 1970 through 1976 that could be attributed to

22. In fact, the estimated coefficient is significantly smaller than zero, suggesting the possibility that BART might have induced negative effects on certain areas. Potential reasons for negative effects include (a) incomplete recovery from losses incurred during BART's construction, and (b) continuation of a previous declining tendency for stores in the near-BART areas.

BART. If anything, the data suggest that in some areas there may have been a negative impact associated with proximity to BART during those years.

Interviews with retail merchants and financial institutions generally support these observations. Only 6 (18 percent) of the 33 informants who responded to the question about BART's effects on retail sales felt that BART had a positive effect. The others felt that BART had no effect on their sales. These results correspond closely to the findings of the Institutions and Lifestyles Project of the BART Impact Program, which found that about 20 percent of downtown Oakland merchants believed that BART was improving their sales. Two informants interviewed in the Study of Property Acquisition and Ownership element of the Land Use and Urban Development Project thought that BART had caused sales to decrease in some areas. Capwell's in Fremont was said to be losing sales to Capwell's in Oakland, and in general Fremont was said to be losing retail business to San Francisco. One informant believed that, with the possible exception of Capwell's, BART had caused sales to decline in downtown Oakland.

Four firms we interviewed had entrances opening directly into BART stations. Two of these four reported that BART was having a positive effect on their sales, so this special convenience to the BART line appears to be a factor influencing BART's effect on sales. (C-19, C-35) The observation is further supported by interviews for the Study of Property Acquisition and Ownership element, where Capwell's in Oakland (with its own BART entrance) was thought to be the only store there which has benefitted from BART.

4. EXPECTATIONS AND IMPLICATIONS

EXPECTATIONS

Although our findings show that BART has not greatly affected the pattern of retail sales and services in the Bay Area, there is some indication that its effects will become more pronounced in the future. We found that shoppers who had recently begun to shop in downtown San Francisco, downtown Oakland, and Walnut Creek were more apt to be BART riders than shoppers who had patronized the areas before 1974. In other words, newer shoppers tended to be BART users. One may infer that BART will aid a shift in sales to these three areas as each year more new shoppers appear. Furthermore, as traffic congestion worsens and as possible restrictions on automobile driving occur in the forms of fuel prices or parking restrictions, the attractiveness of BART travel should increase, and BART may have a correspondingly greater effect on sales patterns. Our regression finding of a possible negative BART effect on sales in downtown San Francisco, Oakland, and Berkeley may relate to temporary construction-related losses, or to data irregularities, and do not necessarily contradict the projection of future positive impacts.

BART's indirect effect on retail sales and service patterns is likely to exceed its direct effect. BART was found to have attracted new commercial and residential development in some areas,[23] and development itself can be expected to attract other retail and service businesses. It is still too early to determine the effects of BART's permanent Saturday service, which began in November 1977. One might expect, however, that because traffic congestion is typically less severe on Saturdays, most shoppers will continue to utilize private vehicles for their trips. Thus, it seems probable that Saturday service will not noticeably influence shopping patterns.

IMPLICATIONS FOR OTHER CITIES

Cities looking for a new transit system to revitalize the older downtown retail areas will find some support from this study, but the effect to date in San Francisco and Oakland has been only minor. Only a few informants reported any BART effect on sales, and most of these stores had a direct entrance to their stores from the BART station. Analysis of retail sales patterns from 1970 through 1976 failed to show that proximity to BART positively influenced growth in sales.

The reasons that stores do not view BART as an important factor in their location decisions may apply equally to fixed-rail transit systems outside the Bay Area. Although we found transportation access a vital factor in stores' location

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23. See John Blayney Associates/David M. Dornbusch & Company, Inc., Study of Households' Location Decisions (February 1978), Study of the Housing Industry (September 1977), Study of the Office Construction Industry (August 1977), and Study of Employers' Location Decisions (March 1978), (Berkeley: BART Impact Program Land Use and Urban Development Working Papers).

decisions, urban stores located so as to gain access to bus service, while the suburban stores located near good automobile access. BART was not considered very important by either group. Other cities with highly developed bus systems are likely to experience the same result.

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APPENDIX A. SHOPPER SURVEY - SURVEY INSTRUMENT

TYLER RESEARCH ASSOCIATES INC.
50 Francisco Street, Suite 495
San Francisco, California 94133
102877-F

Card 1 Col. 1-1
Project #95218 Col. 2-6
Work Element #9
October, 1977

BEGINNING TIME: _____ I.D. No. _____ 7-9

SHOPPING LOCATION: _____ AT STORE: _____ 10-1

AT STATION: _____ -2

SHOPPING LOCATION STUDY

Hello, I'm _____ from Tyler Research, a national public opinion research firm. We are conducting a survey about why people shop where they do, and I'd like to ask you a few brief questions.

1. First, are you in this area on a shopping trip, are you here for some kind of personal errand (like a dentist appointment or banking trip), or are you here for job or school related reasons?

	Number of Responses
Here on shopping trip	324
Here on a personal errand	175
Here for job or school related reasons (TERMINATE)	

2. (HAND RESPONDENT MAP)[24] Do you live in one of the numbered areas on this map? (IF "YES," RECORD NUMBER OF AREA. IF "NO," TERMINATE)

Live in Area Number ___[25]	499
Do not live in numbered area ( ) (TERMINATE)	

24. The map used in the survey is reproduced in **Figure 3.**

25. The variation in responses to questions 2, 4, 7a and 7d was too large to include them here. Responses to these questions are shown in Appendix B.

Fig. 3 - Shopper Survey Map

3. How long have you lived in that area? Have you lived there: (READ AND RECORD BELOW)

Less than 3 years, or	(TERMINATE)
Three years or more	499

4. (HAND RESPONDENT MAP) Do you work in one of the numbered areas shown on this map? (IF "YES," RECORD NUMBER OF AREA. IF "NO," SKIP TO Q.6)

Work in Area Number ___[26]	
Do not work ( ) (SKIP TO Q.6)	291
Do not work in numbered area ( ) (SKIP TO Q.6)	1

5. How long have you worked in that area? Have you worked there: (READ LIST AND RECORD BELOW)

Less than 3 years, or	70
Three years or more	131

6. Did you come to this shopping area: (READ LIST AND RECORD BELOW)

From home	340
From another shopping area	44
From where you work	45
From school	24
From a friend or relative's home	12
From a restaurant	5
From a movie or some other kind of entertainment	1
From another place _____ (SPECIFY)	22
No answer	6

7a. Approximately how many times would you say you have come to this shopping area in the past month? (RECORD EXACT NUMBER)

Number of times ____01 - 99[27]____

7b. Did you use BART to get to this shopping area today? (RECORD BELOW)

Yes, used BART (SKIP TO Q.7d)	245
No, did not use BART	254

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26. Supra, footnote 25.

27. Supra.

7c. Do you ever use BART to come shopping in this area?

Yes, use BART	64
No, never use BART (SKIP TO Q.7e)	190

7d. Of the (NUMBER OF TIMES MENTIONED IN Q.7a) times that you have come to this shopping area in the past month, how many of those times did you use BART to get to this shopping area?

times used BART 00 - 99[28]

% 000 - 100

7e. Will you be using BART when you leave this area to go to some other place today? (RECORD BELOW)

Yes, will use BART to go to another place	199
No, will not use BART	300

8a. How long have you been using this area for shopping or for your personal errands? (READ LIST AND RECORD BELOW)

Less than 3 years (SKIP TO Q.8d)	69
Three years or more	430

8b. Would you say that you use this area more for shopping or for personal errands now than you did three years ago?

Yes, use more	177
No, do not use more (SKIP TO Q.8e)	253

8c. Why is it that you use this area more for shopping or for personal errands now than you did three years ago?

Improved shopping, new stores, lower prices, remodeled area	37
Other areas not as good, more expensive, not safe to go to	1
Can use BART (SPECIFIC MENTION)	44
Improved public transportation access to area (OTHER THAN BART)	12
Work or live in area now	46
Other _____ (SPECIFY)	32
Personal reasons (i.e., friends/relatives in area	11
No answer	3

28. Supra, footnote 25.

8d. Why is it that you have started to use this area for shopping or for personal errands in the past three years?

Improved shopping, new stores, lower prices, remodeled area	9
Other areas not as good, more expensive, not safe to go to	1
Can use BART (SPECIFIC MENTION)	15
Improved public transportation access to area (OTHER THAN BART)	1
Work or live in area now	11
Other _____ (SPECIFY)	23
No answer	9

8e. Which of the following statements best describes the errand or shopping trip you are on today? Would you say you are: (READ LIST)

Shopping for groceries	64
Shopping for personal items like clothing	202
Shopping for household items like linens or dishes	25
Shopping for household appliances like radios or TVs	13
Shopping for household furniture	7
On a personal errand, like a dentist appointment or a banking visit	172
On some other kind of shopping trip (PROBE: Could you give me a brief description of the kind of shopping trip you are on?) _____ _____	28
Christmas/gift shopping	60
No answer	2

8f. At the end of your shopping here, will you be going: (READ LIST AND RECORD BELOW)

To home	371
To another shopping area	39
To where you work	23
To school	4
To a friend or relative's home	19
To a restaurant	18
To a movie or some other kind of entertainment	5
To some other place _____ _____ (SPECIFY)	19
Don't know/No answer	1

9. (HAND RESPONDENT SHOPPING CARD A) Which of the shopping areas shown on this card do you use most frequently?

10. (FOR EACH SHOPPING AREA THE RESPONDENT USES, ASK:) Do you ever use BART when you are going to or from a shopping trip to (SHOPPING AREA)? (REPEAT FOR EACH SHOPPING AREA USED.)

11. (HAND RESPONDENT SHOPPING CARD A) Which of these shopping areas did you use most frequently three years ago?

(LIVED OUT OF BAY AREA 3 YEARS AGO—CHECK HERE ( ) AND SKIP TO Q.12)

	Q.9 Use Most Now # of Responses	Q.10 Use BART to Get To or From # of Responses	Q.11 Used Most 3 Years Ago # of Responses
Downtown San Francisco	239	152	188
Downtown Oakland	122	70	92
Downtown Berkeley	125	64	104
Mission District	47	26	36
El Cerrito Plaza	103	44	96
Bay Fair	18	7	15
Fremont Fashion Plaza	7	5	3
Downtown San Leandro	6	1	6
Downtown Walnut Creek	83	38	52
Downtown Hayward	16	5	13
Downtown Fruitvale	7	2	3
Other East Bay Shopping Area(s)	83	16	63
Other West Bay Shopping Area(s)	41	5	33

Just to make sure we are talking to a good cross-section of people, I have a few background questions.

12. Do you own or have regular access to the use of a _____?

	Yes # of Responses	No # of Responses	No Answer # of Responses
Car	297	201	1
Truck or Van	23	473	3

13. In 1976, was your total household income above or below $15,000, before taxes? Please tell me when I reach the category which includes your total annual family income. (BEGIN READING CATEGORIES ABOVE OR BELOW $15,000.)

13. (Continued from previous page)

	Number of Responses
None or less	16
Under $5,000	79
$5,000 to less than $7,000	38
$7,000 to less than $10,000	65
$10,000 to less than $15,000	81
$15,000 to less than $20,000	62
$20,000 to less than $25,000	48
$25,000 to less than $50,000	42
$50,000 or more	21
Refused/No Answer	47

14. Which of the following categories includes the last grade of school that you completed?

No formal schooling	2
Up to 8th grade	28
9th through 11th grade	34
High school graduate	122
Trade or vocational school	21
One year of college	66
Two or three years of college (including junior college)	76
College graduate	95
One year or more of graduate school	50
Refused	5

15. Which of the following categories describes your current marital status? Which describes your marital status 3 years ago?

	Now # of Responses	3 Years Ago # of Responses
Married	200	197
Separated	14	7
Widowed or divorced	93	80
Never married	188	210
Refused	4	5

16. Which of the following categories includes your age?

	# of Responses
Under 19	51
20 to 24	64

16. (Continued from previous page)

	# of Responses
25 to 29	66
30 to 34	37
35 to 39	25
40 to 44	22
45 to 49	24
50 to 54	30
55 to 59	40
60 to 64	25
65 to 69	51
70 and over	9

17. Which of the following categories best describes your ethnic background?

American Indian or Alaskan Native	3
Asian or Pacific Islander	20
Black/African-American	62
Spanish-American/Spanish Heritage	39
Caucasian/White	374
Other _____ (SPECIFY)	1

18. (RECORD BY OBSERVATION)

Sex:

Female	352
Male	147

Those are all the questions I have. Thank you very much for participating in this survey. The study is being conducted for the Metropolitan Transportation Commission in an effort to understand the effects of public transportation services on the communities they serve. The results of this study will aid in planning for better service in this and other communities throughout the country. Your help is appreciated in this effort.

INTERVIEWER'S NAME _____

DATE _____

TIME COMPLETED _____

APPENDIX B. SHOPPER SURVEY - RESULTS OF QUESTIONS 2, 4, 7a AND 7d[29]

QUESTION 2. AREA OF RESIDENCE

Category Label	Absolute Freq	Relative Freq (Pct)
RICHMOND-EL CERRITO	71	14.2
OAKLAND-BERKELEY	172	34.5
CENTRAL CONTRA COSTA	83	16.6
SAN LEANDRO	13	2.6
HAYWARD-FREMONT	16	3.2
LIVERMORE	2	.4
SF CBD	14	2.8
OTHER SF	117	23.4
DALY CITY	11	2.2
TOTAL	499	100.0

VALID CASES 499
MISSING CASES 0

29. The results of these survey questions were too lengthy to include next to the questions in Appendix A.

QUESTION 4. AREA OF WORKPLACE

Category Label	Absolute Freq	Relative Freq (Pct)
	293	58.7
RICHMOND-EL CERRITO	10	2.0
OAKLAND-BERKELEY	78	15.6
CENTRAL CONTRA COSTA	24	4.8
SAN LEANDRO	5	1.0
HAYWARD-FREMONT	7	1.4
LIVERMORE	1	.2
SF CBD	16	3.2
OTHER SF	61	12.2
DALY CITY	4	.8
TOTAL	499	100.0

VALID CASES 499
MISSING CASES 0

QUESTION 7a. TRIPS PER MONTH TO SHOPPING AREA

	Trips Per Month	Absolute Freq	Relative Freq (Pct)	Adjusted Freq (Pct)	Cum Freq (Pct)
	01	89	17.8	17.9	17.9
	02	72	14.4	14.5	32.5
	03	44	8.8	8.9	41.3
	04	59	11.8	11.9	53.2
	05	34	6.8	6.9	60.1
	06	18	3.6	3.6	63.7
	07	2	.4	.4	64.1
	08	24	4.8	4.8	69.0
	09	1	.2	.2	69.2
	10	23	4.6	4.6	73.8
	12	14	2.8	2.8	76.6
	14	2	.4	.4	77.0
	15	19	3.8	3.8	80.8
	16	4	.8	.8	81.7
	20	29	5.8	5.8	87.5
	22	1	.2	.2	87.7
	23	2	.4	.4	88.1
	24	3	.6	.6	88.7
	25	10	2.0	2.0	90.7
	28	2	.4	.4	91.1
	30	41	8.2	8.3	99.4
	60	2	.4	.4	99.8
	99	1	.2	.2	100.0
NO ANSWER	++	3	.6	MISSING	100.0
	TOTAL	499	100.0	100.0	

QUESTION 7d. BART TRIPS PER MONTH TO SHOP IN AREA

	Trips Per Month	Absolute Freq	Relative Freq (Pct)	Adjusted Freq (Pct)	Cum Freq (Pct)
NEVER USE BART	--	190	38.1	38.6	38.6
	00	22	4.4	4.5	43.1
	01	90	18.0	18.3	61.4
	02	51	10.2	10.4	71.7
	03	28	5.6	5.7	77.4
	04	24	4.8	4.9	82.3
	05	16	3.2	3.3	85.6
	06	5	1.0	1.0	86.6
	07	2	.4	.4	87.0
	08	10	2.0	2.0	89.0
	09	2	.4	.4	89.4
	10	6	1.2	1.2	90.7
	12	9	1.8	1.8	92.5
	14	2	.4	.4	92.9
	15	7	1.4	1.4	94.3
	16	1	.2	.2	94.5
	20	10	2.0	2.0	96.5
	23	1	.2	.2	96.7
	24	2	.4	.4	97.2
	25	4	.8	.8	98.0
	28	1	.2	.2	98.2
	30	8	1.6	1.6	99.8
	60	1	.2	.2	100.0
NO ANSWER	++	7	1.4	MISSING	100.0
	TOTAL	499	100.0	100.0	

APPENDIX C. KEY INFORMANTS INTERVIEWED FOR THIS WORK ELEMENT

1. Mr. Bernard Averbuch - Market Street Development Project - San Francisco
2. Representative - Retail Chain - Oakland, Walnut Creek and Hayward
3. Mr. Becker - Roos Atkins - El Cerrito Plaza
4. Mr. Martin Vitz - San Leandro Community Planning Department - San Leandro
5. Mr. Ronald Nahas - R.T. Nahas Company - San Leandro
6. Representative - Department Store - San Francisco
7. Mr. Hinks - Hinks of Berkeley - Berkeley
8. Mr. Robert Mann - Cost Plus - Walnut Creek
9. Mr. Futak - Montgomery Ward - Bay Fair
10. Mr. Harry Rhorer - Crocker National Bank - San Francisco, Oakland, Bay Fair
11. Mr. Al Lindberg - Bay Fair Shopping Center - Bay Fair
12. Representative - Furniture Store - Hayward
13. Mr. Bruce Winnie - R.B. Furniture - El Cerrito
14. Mr. Dick Craft - Bullock's - Oakland, Walnut Creek, San Francisco
15. Representative - Furniture Store - Hayward
16. Mr. Bud Young - Montgomery Wards - Bay Fair, Fremont
17. Representative - Department Store - Berkeley
18. Representative - Savings and Loan - Bay Area
19. Mr. William LeFevre - Woolworth's - San Francisco
20. Representative - Department Store - Fremont
21. Representative - Clothing Store - Oakland
22. Mr. William McGuire - Wells Fargo Bank -Oakland
23. Representative - Department Store - Oakland

24. Mr. Phil Novak - Fidelity Savings and Loan - Oakland

25. Representative - Clothing Store - Oakland

26. Mr. George Rodriguez - Mi Rancho Market - Mission District

27. Mr. Lester Riggins - California GSA - Mission District and Bay Area

28. Mr. Philo Holland - Sears - Mission District

29. Mr. Clarke Stone - Macy's - San Francisco

30. Mrs. Josephine Tashjian - Si Tashjian Flowers & Gifts - Mission District

31. Mr. Clarke Stone - Macy's - Richmond

32. Mr. Matt Vasquez - Matt Vasquez Optical - Mission District

33. Representative - Furniture Store - Mission District

34. Representative - Clothing Store - Oakland

35. Spokesperson - Capwell's - Oakland, El Cerrito, Fremont

APPENDIX D. QUESTIONS ASKED KEY INFORMANTS INTERVIEWED FOR THIS WORK ELEMENT

I. TYPE OF ORGANIZATION (merchandise sold/service provided):

II. CLIENTELE in terms of:

1. Age group:
2. Sex:
3. Racial/ethnic identity:
4. Income level:
5. Area of residence (local, city-wide, Bay Area):

III. BUSINESS DAYS AND HOURS:

IV. PLACE OF BUSINESS:

1. When was it decided to move into present location?
2. When did construction or remodeling begin on this location?
3. When was it opened for business (year):
4. What was your previous location?
5. Why did you leave your previous location?

V. DECIDING ON LOCATION IN THIS CITY:

(Do not read. Check on basis of reply.)

1. What factors were considered in deciding to locate at this site?	2. How important was this factor?[30]
a. Already here_____	_____
b. Labor supply_____	_____

30. (1) not important enough to sway a decision by itself
(2) possibly important enough to sway a decision
(3) definitely important enough to sway a decision

c. Site availability_____ _____

d. Room for expansion_____ _____

e. Land prices_____ _____

f. Access to suppliers_____ _____

g. Access to customers_____ _____

h. Access to employees_____ _____

i. Taxes_____ _____

j. Amenities (parks views, etc.)_____ _____

k. Transportation facilities_____ _____

l. Political/social environment_____ _____

m. Other_____ _____

n. Other_____ _____

3. Was accessibility of transportation a factor .....

4. How important was this factor?[31]

a. Accessibility by auto ..... _____

b. Accessibility by bus ..... _____

c. Accessibility by BART ..... _____

d. Accessibility by rail ..... _____

VII. BUSINESSES WHICH MOVED FROM THE BART AREA:

1. Why did you leave?

2. Was increased rent a factor in your decision to leave?

3. Was the rent increase because of BART?

VIII. BUSINESSES WHICH HAVE MOVED INTO BART AREA:

1. Did you have to pay a premium rent or land price for the location near BART?

   Was the price per square foot?

   What was the price per square foot for a location beyond BART walking distance?

---

31. (1) not important enough to sway a decision by itself
    (2) possibly important enough to sway a decision
    (3) definitely important enough to sway a decision

IX. IF FIRM HAS NOT MOVED IN 15 YEARS:

1. Has there been a change in the attractiveness of this business site? What change?

2. Has the site become more or less accessible for employees?

3. Have your land costs or rent increased because of BART? In what way and how much?

X. AFTER BART BEGAN OPERATION:

1. Was there a change in the volume or type of business you were doing? What kind of change?

   Were changes related to BART? How so?

2. Was there a change in the business days or hours? What change?

   Were changes related to BART? How so?

3. Did you direct advertising toward BART riders? What have you done?

XI. DURING THE LAST TWO CHRISTMAS SEASONS:

1. Was there a difference because of BART in the volume or type of business your organization did? What was the difference?

2. Were there changes in the business days or hours because of BART? What changes?

3. Was there a difference in your advertising because of BART? What difference?

XII. WHEN WEEKEND SERVICE WAS/IS INITIATED:

1. Was/will there be a change in volume or type of business you do? What kind of change?

2. Was/will there be a change in the days or hours of business? What change?

3. Will you make changes in your advertising? What changes?

XIII. BART RIDERS

1. Can you tell BART riders from other customers by:

   ___ a. Age? Difference? _____

   ___ b. Sex? Difference? _____

___ c. Race? Difference? _____

___ d. Time of day? Difference _____

___ e. Type of purchase? Difference _____

___ f. Size of purchase? Difference _____

XIV. IF IN BUSINESS HERE DURING BART CONSTRUCTION PERIOD:

CLIENTELE

1. Did the volume of people moving in and out of your place of business increase or decrease?

2. Was there a difference in the clientele served by your business—age, sex, racial/ethnic identity, income level, area of residence? What change?

3. Were your sales or receipts lowered or increased during the period of construction?

XV. IF IN BUSINESS HERE DURING BART CONSTRUCTION PERIOD:

OPERATING PROCEDURES

1. Were there changes in the business days or hours? What changes?

2. Were there changes in prices? What changes?

3. Were there changes in your advertising? What changes?

4. Were there layoffs of employees or increases in number of employees?

XVI. IF BART HAD NOT BEEN BUILT:

1. Where would the business have been located? For what reasons?

XVII. EMPLOYEES

1. What proportion of your employees use BART?

2. Do more or fewer employees use BART now than a year ago?

3. Are newer employees more likely to use BART than employees with long tenure?

4. Has BART affected your ability to hire and/or keep employees? Which way?

5. Because of BART are you getting more applicants for jobs from minori-

ties? From inner city residents?

Is BART their main means of getting to work?

6. Are the same persons applying now as before the time that BART was in operation?

7. Does/did the firm provide more or fewer parking spaces when located within walking distance of BART?

XVIII. VISIBILITY OF FIRM FROM BART LINE

1. Can/could BART riders see your firm from the BART line?

2. Was it intended that the firm should be visible?

3. How valuable do you consider visibility to be?

XIX. OTHER PERSONS TO BE INTERVIEWED

1. Do you know others we could talk with about speculation, about land and rent increases due to BART? May I have their names?

THANK YOU FOR TAKING THE TIME TO TALK WITH US.

Would you be willing for us to attribute to you things which you have said?

APPENDIX E. KEY INFORMANTS INTERVIEWED - ECONOMICS AND FINANCE PROJECT

1. Mr. Clarence Betz - Manager - Orinda Chamber of Commerce

2. Mrs. Ann Lohr - Manager - Orinda Chamber of Commerce

3. Mr. Stanley Allen - Executive Vice-President - Fremont Chamber of Commerce

4. Mr. Harry Stoopes - Executive Vice-President - Berkeley Chamber of Commerce

5. Mr. John Horton - Executive Vice-President - Richmond Chamber of Commerce

6. Mr. Angelo Siracusa - Executive Vice-President - Bay Area Council

7. Mr. Paul Huey - Executive Vice-President - Contra Costa County Development Association

8. Mr. Lance Burris - Director - Richmond Redevelopment Agency

9. Mr. Burton Bangsberg - Assistant Director - Oakland Office of Community Development - Oakland City Center

10. Mr. William Rugg - Director - San Leandro Redevelopment Agency

11. Mr. Barry Reubens - Manager of Technical Analysis and Site Selection - Great Western Savings

12. Mr. Anthony Fisher - Manager of Commercial Development - Crocker Land Company

13. Mr. Michael Wyant - Director of Branch Locations - Home Savings and Loan Association

14. Mr. Harold Ellis - President - Grubb & Ellis Real Estate

15. Mr. Robert Sullivan - President - San Francisco Convention and Visitors Bureau

16. Mr. D. T. Daggett - Vice-President/General Manager - Southern Pacific Railroad Land Development Company

17. Mr. Richard Betts - President - Urban Property Analysis - Berkeley

18. Mr. John Dykstra - Consultant - Pacific Rim Associates - San Francisco

19. Mr. Dale Odell - Project Director - Oakland City Center Project

20. Mr. Robert Symonds - Vice-President - California Federal Savings and Loan Association - San Francisco

21. Mr. Robert Wilmoth - Vice-President, Branch Locations - Crocker National Bank - San Francisco

22. Mr. John Hill - Branch Manager - Great Western Savings - Berkeley

23. Mr. Dwight Reeka - Owner/Manager - The Elegant Ranch Restaurant - Hayward

24. Mr. Thayer Barcelon - Manager - Terminal Shopping Center - Concord

25. Mr. Harold Fritz - Manager - J. C. Penney Department Store - Berkeley

26. Mr. Robert Neil - Manager - Fremont Fashion Center - Fremont

27. Mr. Howard Henderson - Store Manager - Emporium/Capwell's - San Francisco

28. Mr. Michael Rosenquist - Transportation Planner - City of Walnut Creek

29. Mr. Robert Piper - Director - Department of Transportation - Berkeley

30. Mr. Robert Bagley - General Manager - Towne Hotel - San Francisco

31. Mr. Thomas R. DeAngelo - General Manager - Sheraton Palace Hotel - San Francisco

32. Mr. Reginald Stuart - City Manager - Concord

APPENDIX F. KEY INFORMANTS INTERVIEWED - STUDY OF OFFICE CONSTRUCTION INDUSTRY

1. Representative - Major Bank - San Francisco

2. Messrs. Tom Hirschfeld and Al Jones - Richmond Redevelopment Agency - Richmond

3. Dr. James McMillian - Pharmacist - Richmond

4. Mr. Nathaniel Bates - Richmond City Councilman - Richmond

5. Mr. Robert Anderson - Citizens Savings and Loan - Oakland

6. Mr. Elwood Hansen - Bayview Federal Savings and Loan - Mission District - San Francisco

7. Mr. Ben Ramos - Mission Economic Development Association - Mission District - San Francisco

8. Mr. Leandro P. Soto - OBECA/Arriba Juntos - Mission District - San Francisco

APPENDIX G. RETAIL SALES ESTIMATED REGRESSION EQUATIONS AND CORRELATION MATRICES

Three estimated regression equations were discussed under the findings of Hypothesis 3 but not presented. They are given below along with the correlation matrices for their coefficients.

Equation 2, the estimated regression equation for growth in retail sales for large stores in all seventeen areas studied, was not significant at the .05 level.[32]

EQ. 2	B = 7.95INC	+ 108.2COMP	+ 3.16POPP	+ 125D4	+ 143
(t-statistic)	(2.386*)	(1.201)	(.533)	(1.193)	(-2.380*)

$n = 16$

$R^2 = .48$

$F_{(4,11)} = 2.546$

where B = estimated real growth in retail sales, 1970 to 1976
INC = change in income in the primary market area, 1970 to 1976
COMP = number of new large stores within $2\frac{3}{4}$ miles
D4 = proportion of stores located within 1,500 feet walking distance of a BART station

*Asterisk indicates significance at the .05 level.

Although the distance measure was not significant at the .05 level, correlation of this coefficient with the population coefficient limits our knowledge of D4's actual significance. The correlation matrix for the coefficients in Equation 2 is presented below.

CORRELATION MATRIX FOR COEFFICIENTS OF EQ. 2

	INC	COMP	POPP	D4	C
INC	1.0	.007	.289	-.036	.385
COMP		1.0	.265	.129	.347
POPP			1.0	-.582	-.021
D4				1.0	-.520
C					1.0

32. The equation was significant at the .10 level, however, and we have proceeded with further analysis of the relationship.

We see that as proximity to BART (D4) increases, population growth declines. This relationship corresponds to observable trends in the 1970s toward declining population in central cities and downtowns (where most BART stations are located) and continued growth of outlying areas.

The estimated regression equation for the mixed sample of small and large stores for all seventeen areas studied was found to be significant at the .05 level. The equation, **Equation 3**, is shown below.

EQ. 3 $B = -18.9FWY - .0036VOL + 1.27POPP + 25.3D3 + .99$

(t-statistic) (-2.289*)(-1.984*) (2.371*) (1.388) (.191)

$n = 82$

$R^2 = .15$

$F_{(4,77)} = 3.350^*$

where FWY = number of new freeways within 1/2 mile of the center (since 1970)
VOL = initial sales volume per store
POPP = population change in primary market area, 1970 to 1976
D3 = proportion of stores within 600 feet walking distance of a BART station

*Asterisk indicates significance at the .05 level.

Once again, however, the distance measure coefficient was found to correlate highly with population, as evidenced by the correlation matrix. We cannot, therefore, distinguish the effect of distance to BART alone on retail sales.

CORRELATION MATRIX FOR COEFFICIENTS OF EQ. 3

	FWY	VOL	POPP	D3	C
FWY	1.0	-.110	.100	.310	.309
VOL		1.0	.145	.247	.128
POPP			1.0	-.643	-.080
D3				1.0	.317
C					1.0

In the reaggregated data for San Francisco, Oakland, and Berkeley, multicollinearity problems occurred in our analysis of the large-store sets. The estimated regression equation was:

EQ. 4	B =	-.025VOL +	10.3POPP -	.61INC -	45.8D7 + 160
(t-statistic)		(-8.919*)	(1.535)	(-.525)	(-1.007) (2.054*)

$n = 10$

$R^2 = .97$

$F_{(4,5)} = 46.94^*$

where VOL = initial sales volume per store
POPP = population change in primary market area, 1970 to 1976
INC = change in income in primary market area, 1970 to 1976
D7 = proportion of stores within 300 feet walking distance of a BART station

---

*Asterisk indicates significance at the .05 level.

And the corresponding correlation matrix for the coefficients of Equation 4:

CORRELATION MATRIX FOR COEFFICIENTS OF EQ. 4

	VOL	POPP	INC	D7	C
VOL	1.0	.528	-.550	.656	.567
POPP		1.0	.425	-.386	-.977
INC			1.0	.415	.414
D7				1.0	-.326
C					1.0

Because the coefficients of D7 and VOL were highly correlated (larger stores tended to be nearer BART stations), and to some extent also with INC, we cannot interpret D7's coefficient's lack of significance as evidence that the variable is not significant in the relation. When tested for their joint significance (using the test presented in the text), the factors D7 and VOL were found to be jointly significant at the .05 level. Given this relation, one can develop a simple predictive model for B, growth in sales, in terms of D7 only, but accounting for the joint relationship between D7 and VOL. VOL can be expressed in terms of D7 as

$$y = a + bX$$

where y stands for VOL and X for D7, and where b and a are determined by

$$b = r_{XY} \frac{S_Y}{S_X} \qquad \text{and} \qquad a = \overline{Y} - b\overline{X}$$

Thus,

$$Y = r_{XY} \frac{S_Y}{S_X} X + \bar{Y} - b\bar{X}$$

or,

$$VOL = .521 \left(\frac{7.62 \times 10^3}{.250} \right) D7 + 49723 - (15.89)(.250)$$

$$= 15898D7 + 998$$

Now, restating Equation 4 by substituting the mean values for the other variables POPP and INC, and then substituting for VOL, we have —

$$B = -.025VOL - 10.3(-11.09) - .61(-1.84) - 45.8D7 + 160$$

$$= -.025VOL - 45.8D7 - 47.29$$

$$= -.025(15898D7 + 998) - 45.8D7 + 47.29$$

$$= -435.25D7 + 22.84$$

This simplified relation estimates change in sales for large stores at different distances to BART given mean values for the variables POPP and INC. For example, if D7 = .5, i.e., half of the set of stores are within 300 feet of a BART station, then according to the above relation, one would expect a B value of -195. Translated into real growth in sales, this would imply a drop in real sales of a typical store in the set from $4,000,000 per year to $3,200,000 per year over five years.

Note that such an estimate should not be construed as the result of proximity to BART alone, but is the outcome of the joint effect of volume and distance to BART. Further, the data apply to the 1970 - 1976 period and therefore reflect the influence of the latter period of BART construction.

Equation 1, given in the text, is the only estimated regression equation that is not weakened by multicollinearity. From it we can state, with a .95 level of confidence, that our sales data for San Francisco, Oakland, and Berkeley do not support Hypothesis 3, that retail sales have shifted to stores within walking distance to BART.

APPENDIX H. SHOPPER SURVEY DEMOGRAPHICS

ALL RESPONDENTS

Table 8 compares the demographic characteristics of people in the three-county BART service area, all BART riders, and the survey respondents, both as one group and for each survey location. The table reveals several demographic differences between people in the BART service area or who are BART riders and the people who comprise our sample. First, our sample includes a much higher proportion of females than either live in the BART service area or ride BART on all trips. Because our sample is entirely composed of people on shopping trips or errands, and because most shoppers are female, this result is not surprising. The ratio of males to females is approximately equal at all survey locations except Walnut Creek, where the proportion of females in the sample is 82.5 percent.

Second, the survey sample includes a higher proportion of people over 64 years (21.2 percent) than does either the area-wide statistics (13.6 percent) or the sample of all BART riders (4.8 percent). The highest percentage of older people occurs at El Cerrito Plaza, where 31.2 percent of the respondents were over 64 years old.

Third, respondents at the downtown Berkeley survey location included more people with at least some college education (76.9 percent) than did the shopper survey as a whole (62.2 percent), or than live in the BART service area (49.7 percent). Berkeley's high proportion of college-educated respondents is probably due to the proximity of the University of California at Berkeley.

Fourth, the survey samples from El Cerrito Plaza and the Mission District include more low income people than does either the area-wide statistics or the sample of all BART riders. While the proportion of people living in the BART service area with incomes under $10,000 per year is 39.6 percent, and the proportion of all BART riders with incomes under $10,000 is 31.9 percent, the proportion of respondents with incomes under $10,000 is 65.8 percent at El Cerrito Plaza and 55.3 percent in the Mission District. These figures reflect the income characteristics of the people living around those survey areas.

Fifth, the survey sample's ethnic characteristics reveal each survey location's particular ethnic emphasis: the proportion of Asian respondents is highest in San Francisco (7.5 percent), where the largest concentration of Asians live. Similarly, Oakland shows the highest proportion of blacks (20.9 percent), the Mission District the highest percentage of Spanish-Americans (25.9 percent), and Walnut Creek the highest percentage of whites (96.2 percent).

SHOPPERS WHO RIDE BART VERSUS SHOPPERS WHO DO NOT

Table 9 presents a comparison of the demographic characteristics of the BART and non-BART users sampled in the 1977 Shoppers Survey. The age distribution of BART riders did not vary substantially from that of non-BART users, except

in the under 19 age bracket where BART riders outnumbered other respondents two to one. In the other demographic characteristics studied, very little difference was found between BART and non-BART users (see Table 8). The sex, income, educational and racial attributes of both groups were substantially the same. As expected, fewer persons with access to a private vehicle rode BART to their shopping destination than persons who were without private transportation. Both this finding and the preponderance of young BART riders reflect the dependence of the transportation-disadvantaged upon public transit in general, and upon BART in particular.

SHOPPER SURVEY RESPONDENTS - WHITES VERSUS MINORITIES

Table 10 presents selected demographic characteristics of whites and minorities in the sample. The proportion of males and females surveyed did not vary greatly for the two groups, but major differences were observed in other attributes. A major distinction in the age distributions is apparent: the non-white sample is much more heavily skewed toward younger people (69.0 percent of the non-white sample was under 40 years of age while only 43.2 percent of the white sample was). A greater proportion of the white sample had post-high school educations (48 percent as opposed to 36 percent, non-white), and a larger proportion of whites fell into the higher income categories (43 percent earning more than $15,000 as opposed to 27 percent, non-white). Interestingly, although more white than non-white respondents had access to a private vehicle, a greater proportion of whites used BART to arrive at their shopping destination.

SHOPPER SURVEY RESPONDENTS - MALE VERSUS FEMALE

A comparison of characteristics of the female and the male survey respondents is given in **Table 11.** Some differences are evident in almost every attribute. In age, a greater proportion of the female than male respondents were older than 50, but this may reflect a greater proportion of the population at large. In education, substantially fewer females than males had completed college educations (27 percent versus 35 percent), although of those who had, slightly more females had also had some graduate education. A much greater proportion of males than females had incomes falling below $5,000 (28 percent as opposed to 18 percent). The other characteristics studied—race, access to a private vehicle, and use of BART—exhibited no important differences between the male and the female groups.

TABLE 8. DEMOGRAPHICS OF BART SERVICE AREA, ALL BART RIDERS, AND SHOPPER SURVEY SAMPLE

	BART[a] Service Area Residents	All[b] BART Riders (N=8132)	1977 SHOPPER SURVEY						
			All Locations (N=499)	El Cerrito Plaza (N=81)	Mission District (N=85)	San Francisco (N=80)	Oakland (N=86)	Berkeley (N=87)	Walnut Creek (N=80)
SEX									
M		51.8	29.5	32.1	32.9	32.5	30.2	31.0	17.5
F		48.2	70.5	67.9	67.1	67.5	69.8	69.0	82.5
AGE									
< 18	8.5	2.5	10.2[c]	11.7[c]	3.5[c]	13.9[c]	2.4[c]	7.0[c]	25.3[c]
18-24	17.5	24.7	12.8[d]	6.5[d]	20.0[d]	17.7[d]	16.7[d]	5.8[d]	11.4[d]
25-34	21.1	33.7	20.6	16.1	31.8	20.3	15.5	27.9	12.6
35-44	13.5	14.5	9.4	5.2	11.8	10.1	13.1	9.3	7.6
45-54	14.5	12.5	10.8	11.7	11.8	11.4	11.9	8.2	11.4
55-64	11.3	7.3	13.0	16.9	8.3	10.1	11.9	18.6	14.0
> 64	13.6	4.8	21.2	31.2	12.9	16.5	28.6	23.2	17.7
EDUCATION									
< HS	30.7	4.8	13.0	20.3	16.5	11.2	7.1	3.4	20.3
HS	29.6	15.0	24.7	27.8	31.8	16.2	29.8	19.5	22.8
Some College	19.3	39.3	32.9	17.7	29.4	43.7	40.5	35.6	30.4
4 Yrs. College	20.4	16.6	19.2	24.1	18.8	21.2	14.3	19.5	17.7
4+ Yrs. College		24.3	10.1	10.1	3.5	7.5	8.3	21.8	8.9

TABLE 8 (Continued)

	BART[a] Service Area Residents	All[b] BART Riders (N=8132)	1977 SHOPPER SURVEY						
			All Locations (N=499)	El Cerrito Plaza (N=81)	Mission District (N=85)	San Francisco (N=80)	Oakland (N=86)	Berkeley (N=87)	Walnut Creek (N=80)
INCOME									
< $7,000	39.6	19.7	29.4	52.9	31.6	24.1	25.0	27.4	17.6
$ 7-10,000		12.2	14.4	12.9	23.7	20.3	16.2	9.6	2.7
$10-15,000	18.2	18.3	17.9	7.1	23.7	17.7	20.0	21.9	16.2
$15-20,000	14.4	14.4	13.7	12.9	10.5	15.2	22.5	9.6	10.8
$20-25,000	10.2	14.8	10.6	7.1	7.9	15.2	7.5	15.1	10.8
$25-50,000	17.6	18.0	9.3	5.7	1.3	6.3	5.0	12.3	25.7
> $50,000		2.5	4.6	1.4	1.3	1.3	3.7	4.1	16.2
RACE[e]									
Asian	6.2	7.6	4.0	3.7	4.7	7.5	3.5	4.6	0
Black	12.7	9.5	12.4	12.3	14.1	11.2	20.9	13.8	1.2
Span.-American	12.3	5.4	7.8	2.5	25.9	8.8	5.8	2.3	1.2
White	67.4	76.2	74.9	81.5	54.1	71.2	68.6	79.3	96.2
Other	1.4	1.4	0.8	--	1.2	1.2	1.2	--	1.2

a. SOURCE: Peat, Marwick, Mitchell & Co., Program Final Report (Berkeley: BART Impact Program, Transportation System and Travel Behavior Project, November 1977). 1975 Estimate.

b. SOURCE: MTC, 1976 Passenger Profile Survey (Berkeley: MTC Data Library, 1976).

c. Under 19.

d. 19 - 24.

e. 1970 Census.

TABLE 9. DEMOGRAPHICS OF SHOPPERS WHO RIDE BART AND OF SHOPPERS WHO DO NOT RIDE BART

	1977 SHOPPER SURVEY	
	BART Riders (percent)	Non-BART Riders (percent
ALL RESPONDENTS	48.8(N=245)	51.2(N=254)
	Characteristics Of BART Riders (percent)	Characteristics Of Non-BART Riders (percent)
SEX		
F	68.2	72.8
M	31.8	27.2
AGE		
Under 19	14.1	6.8
20-29	26.2	27.0
30-39	10.3	14.8
40-49	9.5	9.2
50-59	14.1	14.4
60-69	14.1	16.8
70 and older	11.6	10.8
EDUCATION		
No Formal Schooling	0.4	0.4
8th Grade	5.4	5.9
9th-11th Grade	7.9	5.9
High School Graduate	25.7	23.7
Trade School	3.3	5.1
1 Year College	12.9	13.8
2-3 Years College	16.2	14.6
College Graduate	19.5	19.0
Some Graduate Education	8.7	11.5
INCOME		
No Income	2.2	4.8
<$5,000	16.6	18.3
$ 5,000- 7,000	9.9	7.0
$ 7,000-10,000	13.9	14.8
$10,000-15,000	19.3	16.6
$15,000-20,000	13.9	13.5
$20,000-25,000	11.7	9.6
$25,000-50,000	9.0	9.6
>$50,000	3.6	5.7
RACE		
American Indian	0.0	1.2
Asian	3.3	4.7
Black	11.8	13.0
Spanish-American	7.3	8.3
White	77.6	72.4
Other	0.0	0.4
HAVE ACCESS TO A VEHICLE	59.2	69.2

TABLE 10. DEMOGRAPHICS AND BART USE OF SURVEY RESPONDENTS, BY ETHNIC BACKGROUND[a]

	Characteristics Of White Respondents (percent)	Characteristics Of Non-White Respondents (percent)
SEX		
F	69.8	72.8
M	30.2	27.2
AGE		
Under 19	10.3	10.7
20-29	22.3	39.4
30-39	10.6	18.9
40-49	8.2	9.9
50-59	16.1	9.0
60-69	17.6	9.0
70 and older	13.9	3.3
EDUCATION		
No Fomal Schooling	0.5	0.0
8th Grade	5.7	5.7
9th-11th Grade	6.2	8.9
High School Graduate	22.9	30.1
Trade School	3.8	5.7
1 Year College	13.2	13.8
2-3 Years College	14.6	17.9
College Graduate	20.8	14.6
Some Graduate Education	12.4	3.3
INCOME		
No Income	3.8	2.7
<$5,000	17.4	17.9
$ 5,000- 7,000	7.6	10.7
$ 7,000-10,000	13.5	17.0
$10,000-15,000	15.6	25.0
$15,000-20,000	12.6	17.0
$20,000-25,000	12.1	6.3
$25,000-50,000	11.5	2.7
>$50,000	5.9	0.9
HAVE ACCESS TO A VEHICLE	66.8	56.8
USED BART TO ARRIVE	50.8	44.0

SOURCE: David M. Dornbusch & Company, Inc. 1977 Shopper Survey.

a. N = 374 for white respondents; N = 125 for non-white respondents.

TABLE 11. DEMOGRAPHICS AND BART USE OF SURVEY RESPONDENTS, BY SEX[a]

	Characteristics Of Female Respondents (percent)	Characteristics Of Male Respondents (percent)
AGE		
Under 19	9.9	11.7
20-29	24.4	31.7
30-39	11.6	15.1
40-49	10.1	7.6
50-59	15.4	11.7
60-69	16.8	12.5
70 and older	11.9	9.7
EDUCATION		
No Formal Education	0.3	0.7
8th Grade	6.0	4.8
9th-11th Grade	6.9	6.8
High School Graduate	26.1	21.2
Trade School	4.6	3.4
1 Year College	12.6	15.1
2-3 Years College	16.4	13.0
College Graduate	16.4	26.0
Some Graduate Education	10.6	8.9
INCOME		
No Income	3.5	3.6
<$5,000	14.6	24.1
$ 5,000- 7,000	8.9	7.3
$ 7,000-10,000	16.8	8.8
$10,000-15,000	18.1	17.5
$15,000-20,000	14.0	13.1
$20,000-25,000	10.5	10.9
$25,000-50,000	8.9	10.2
>$50,000	4.8	4.4
RACE		
American Indian	0.6	0.7
Asian	3.7	4.8
Black	13.6	9.5
Spanish-American	8.0	7.5
White	74.1	76.9
Other	0.0	0.7
HAVE ACCESS TO A VEHICLE	63.5	66.0
USED BART TO ARRIVE	47.4	53.1

SOURCE: David M. Dornbusch & Company, Inc. 1977 Shopper Survey.

a. N = 352 for females; N = 147 for males.

APPENDIX I. KEY INFORMANTS INTERVIEWED FOR THE STUDY OF PROPERTY ACQUISITION AND OWNERSHIP

1. Mr. Orra Hyde - Coldwell, Banker and Company - Oakland

2. Mr. Herbert Epstein - Director of Economic Development - Fremont